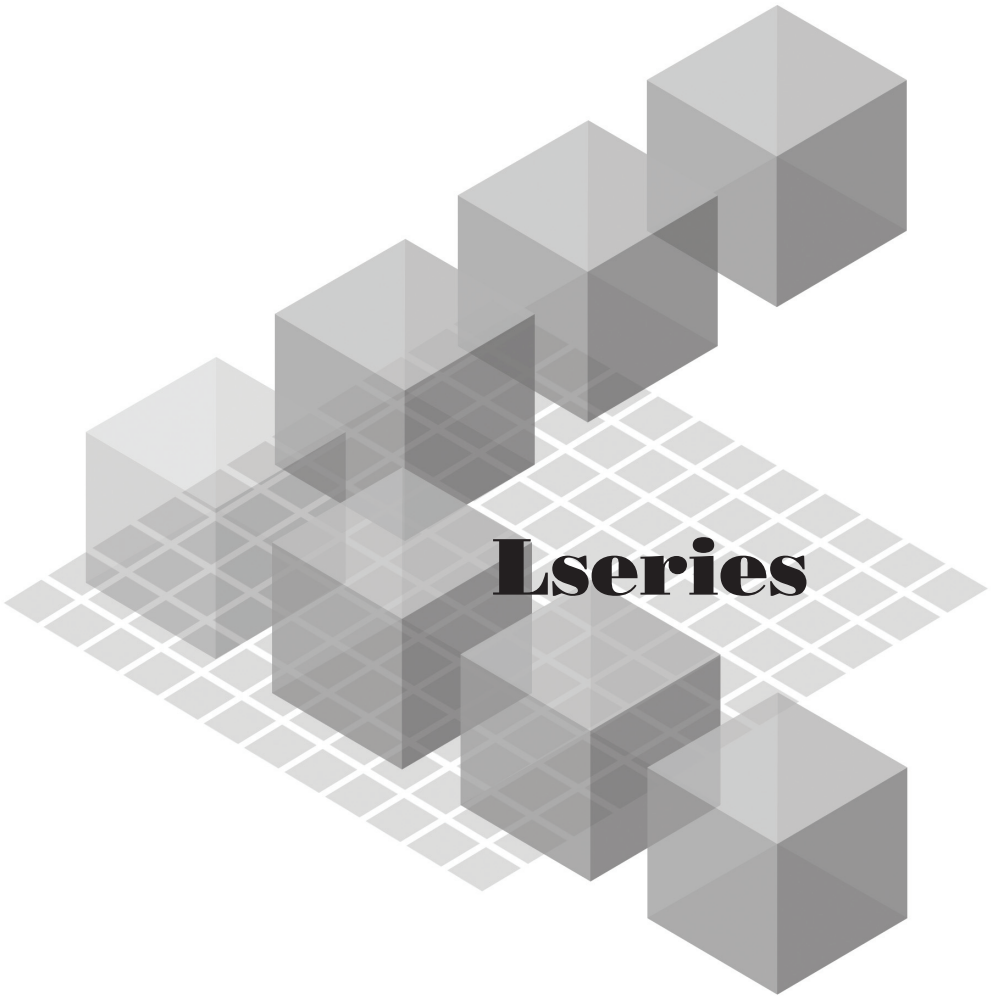
MITSUBISHI

Mitsubishi Programmable Controller

MELSEC *L series*

MELSEC-L Dual Channel Isolated High Resolution Analog-Digital Converter Module User's Manual



MODEL

-L60AD4-2GH

●SAFETY PRECAUTIONS●

(Read these precautions before using this product.)

Before using this product, please read this manual and the relevant manuals carefully and pay full attention to safety to handle the product correctly.
The precautions given in this manual are concerned with this product only. For the safety precautions of the programmable controller system, refer to the user's manual for the CPU module used.

In this manual, the safety precautions are classified into two levels: "⚠WARNING" and "⚠CAUTION".

⚠WARNING	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage.

Under some circumstances, failure to observe the precautions given under "⚠CAUTION" may lead to serious consequences.
Observe the precautions of both levels because they are important for personal and system safety.
Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

[Design Precautions]

⚠WARNING

- Do not write any data to the "system area" and "write-protect area" (R) of the buffer memory in the intelligent function module. Also, do not use any "use prohibited" signals as an output signal from the programmable controller CPU to the intelligent function module.
  Doing so may cause malfunction of the programmable controller system.

[Design Precautions]

⚠CAUTION

- Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 100mm or more between them. Failure to do so may result in malfunction due to noise.
- Do not install the analog signal cables together with the main circuit lines; power cables; or load cables of external devices other than the programmable controller. Keep a distance of 150mm or more between them. Failure to do so may result in malfunction due to noise.

[Installation Precautions]

⚠ WARNING

- Shut off the external power supply (all phases) used in the system before mounting or removing a module. Failure to do so may result in electric shock or cause the module to fail or malfunction.

[Installation Precautions]

⚠ CAUTION

- Use the programmable controller in an environment that meets the general specifications in the Safety Guidelines provided with the CPU module or head module. Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.
- To interconnect modules, engage the respective connectors and securely lock the module joint levers until they click. Incorrect interconnection may cause malfunction, failure, or drop of the module.
- Tighten the screws within the specified torque range. Undertightening can cause drop of the screw, short circuit, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- Do not directly touch any conductive parts and electronic components of the module. Doing so can cause malfunction or failure of the module.

[Wiring Precautions]

⚠ WARNING

- After installation and wiring, attach the included terminal cover to the module before turning it on for operation. Failure to do so may result in electric shock.

[Wiring Precautions]

⚠CAUTION

- Individually ground the FG terminal of the programmable controller with a ground resistance of 100Ω or less. Failure to do so may result in electric shock or malfunction.
- Tighten the terminal block screws within the specified torque range. Undertightening can cause short circuit, fire, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- Prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction.
- A protective film is attached to the top of the module to prevent foreign matter, such as wire chips, from entering the module during wiring. Do not remove the film during wiring. Remove it for heat dissipation before system operation.
- Mitsubishi programmable controllers must be installed in control panels. Connect the main power supply to the power supply module in the control panel through a relay terminal block. Wiring and replacement of a power supply module must be performed by qualified maintenance personnel with knowledge of protection against electric shock. For wiring methods, refer to the MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection).

[Startup and Maintenance Precautions]

⚠WARNING

- Do not touch any terminal while power is on. Doing so will cause electric shock or malfunction.
- Shut off the external power supply (all phases) used in the system before cleaning the module or retightening the terminal block screws. Failure to do so may result in electric shock.

[Startup and Maintenance Precautions]

⚠CAUTION

- Do not disassemble or modify the module. Doing so may cause failure, malfunction, injury, or a fire.
- Shut off the external power supply (all phases) used in the system before mounting or removing a module. Failure to do so may cause the module to fail or malfunction.
- Tighten the terminal block screws within the specified torque range. Undertightening can cause drop of the component or wire, short circuit, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- After the first use of the product (module, display unit, and terminal block), do not connect/disconnect the product more than 50 times (in accordance with IEC 61131-2). Exceeding the limit may cause malfunction.
- Before handling the module, touch a conducting object such as a grounded metal to discharge the static electricity from the human body. Failure to do so may cause the module to fail or malfunction.

[Disposal Precautions]

⚠ CAUTION
● When disposing of this product, treat it as industrial waste.

●CONDITIONS OF USE FOR THE PRODUCT●

(1) Mitsubishi programmable controller ("the PRODUCT") shall be used in conditions;
i) where any problem, fault or failure occurring in the PRODUCT, if any, shall not lead to any major or serious accident; and
ii) where the backup and fail-safe function are systematically or automatically provided outside of the PRODUCT for the case of any problem, fault or failure occurring in the PRODUCT.

(2) The PRODUCT has been designed and manufactured for the purpose of being used in general industries.
MITSUBISHI SHALL HAVE NO RESPONSIBILITY OR LIABILITY (INCLUDING, BUT NOT LIMITED TO ANY AND ALL RESPONSIBILITY OR LIABILITY BASED ON CONTRACT, WARRANTY, TORT, PRODUCT LIABILITY) FOR ANY INJURY OR DEATH TO PERSONS OR LOSS OR DAMAGE TO PROPERTY CAUSED BY the PRODUCT THAT ARE OPERATED OR USED IN APPLICATION NOT INTENDED OR EXCLUDED BY INSTRUCTIONS, PRECAUTIONS, OR WARNING CONTAINED IN MITSUBISHI'S USER, INSTRUCTION AND/OR SAFETY MANUALS, TECHNICAL BULLETINS AND GUIDELINES FOR the PRODUCT.
("Prohibited Application")
Prohibited Applications include, but not limited to, the use of the PRODUCT in;
- Nuclear Power Plants and any other power plants operated by Power companies, and/or any other cases in which the public could be affected if any problem or fault occurs in the PRODUCT.
- Railway companies or Public service purposes, and/or any other cases in which establishment of a special quality assurance system is required by the Purchaser or End User.
- Aircraft or Aerospace, Medical applications, Train equipment, transport equipment such as Elevator and Escalator, Incineration and Fuel devices, Vehicles, Manned transportation, Equipment for Recreation and Amusement, and Safety devices, handling of Nuclear or Hazardous Materials or Chemicals, Mining and Drilling, and/or other applications where there is a significant risk of injury to the public or property.

Notwithstanding the above, restrictions Mitsubishi may in its sole discretion, authorize use of the PRODUCT in one or more of the Prohibited Applications, provided that the usage of the PRODUCT is limited only for the specific applications agreed to by Mitsubishi and provided further that no special quality assurance or fail-safe, redundant or other safety features which exceed the general specifications of the PRODUCTs are required. For details, please contact the Mitsubishi representative in your region.

INTRODUCTION

Thank you for purchasing the Mitsubishi MELSEC-L series programmable controllers.
This manual describes the functions and programming of a dual channel isolated high resolution analog-digital converter module (hereafter abbreviated as A/D converter module).

Before using this product, please read this manual and the relevant manuals carefully and develop familiarity with the functions and performance of the MELSEC-L series programmable controller to handle the product correctly.
When applying the program examples introduced in this manual to an actual system, ensure the applicability and confirm that it will not cause system control problems.

■ Target module: L60AD4-2GH

Remark

- Unless otherwise specified, this manual describes the program examples in which the I/O numbers of X/Y00 to X/Y0F are assigned for an A/D converter module.
  For I/O number assignment, refer to the following.
  MELSEC-L CPU Module User's Manual (Function Explanation, Program Fundamentals)

- Operating procedures are explained using GX Works2. When using GX Developer, refer to the following.
  - When using GX Developer (Page 297, Appendix 7)

COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES

(1) Method of ensuring compliance

To ensure that Mitsubishi programmable controllers maintain EMC and Low Voltage Directives when incorporated into other machinery or equipment, certain measures may be necessary. Please refer to one of the following manuals.

- MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)
- MELSEC-L CC-Link IE Field Network Head Module User's Manual
- Safety Guidelines
  (This manual is included with the CPU module or head module.)

The CE mark on the side of the programmable controller indicates compliance with EMC and Low Voltage Directives.

(2) Additional measures

No additional measures are necessary for the compliance of this product with EMC and Low Voltage Directives.

RELEVANT MANUALS

(1) CPU module user's manual

Manual name <Manual number (model code)>	Description
MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection) <SH-080890ENG, 13JZ36>	Specifications of the CPU modules, power supply modules, display unit, branch module, extension module, SD memory cards, and batteries, information on how to establish a system, maintenance and inspection, and troubleshooting
MELSEC-L CPU Module User's Manual (Function Explanation, Program Fundamentals) <SH-080889ENG, 13JZ35>	Functions and devices of the CPU module, and programming

(2) Head module User's Manual

Manual name <Manual number (model code)>	Description
MELSEC-L CC-Link IE Field Network Head Module User's Manual <SH-080919ENG, 13JZ48>	Specifications, procedures before operation, system configuration, installation, wiring, settings, and troubleshooting of the head module

(3) Operating manual

Manual name <Manual number (model code)>	Description
GX Works2 Version 1 Operating Manual (Common) <SH-080779ENG, 13JU63>	System configuration, parameter settings, and online operations of GX Works2, which are common to Simple projects and Structured projects
GX Developer Version 8 Operating Manual <SH-080373E, 13JU41>	Operating methods of GX Developer, such as programming, printing, monitoring, and debugging

Memo

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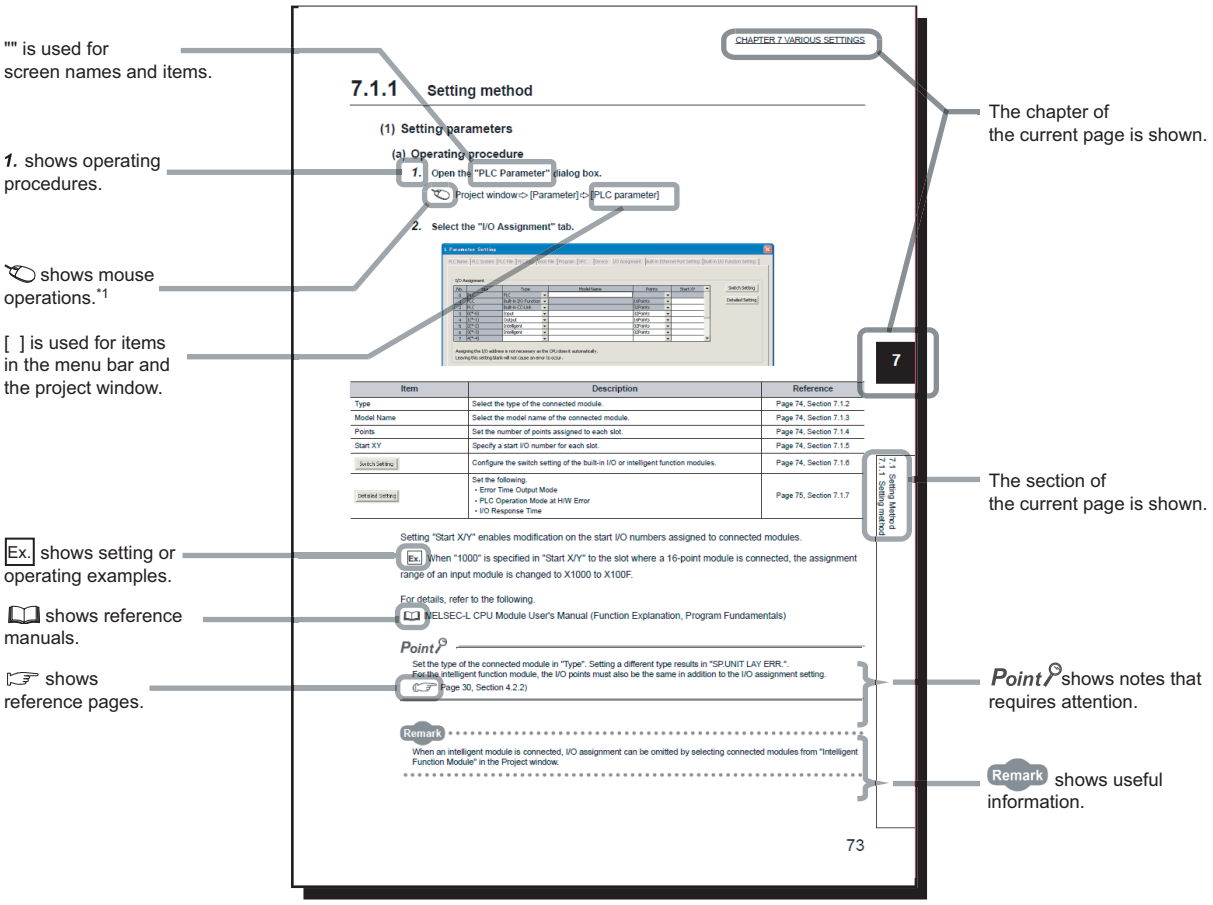
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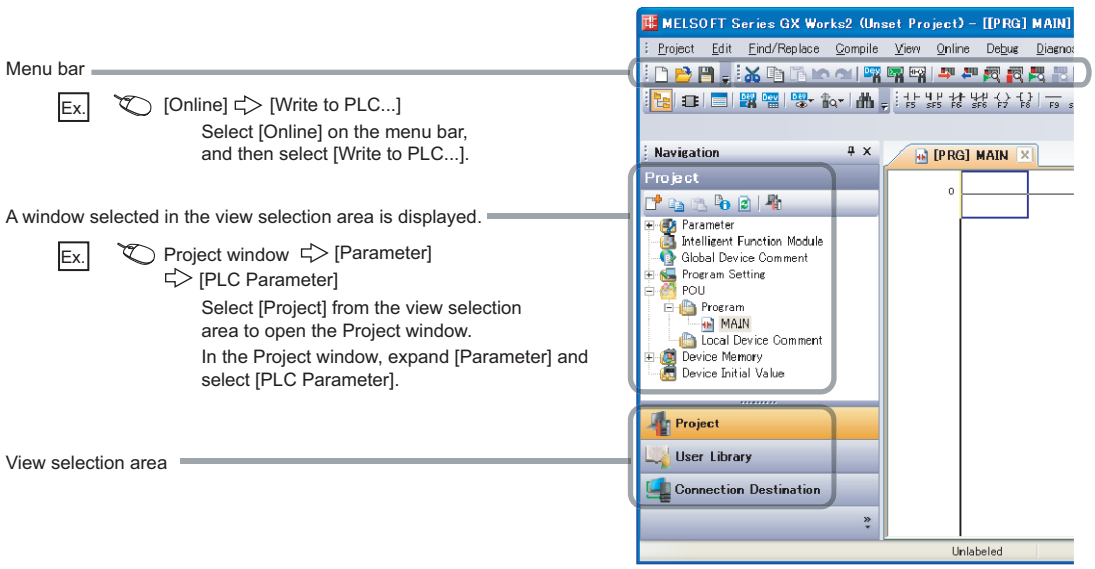
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MANUAL PAGE ORGANIZATION

In this manual, pages are organized and the symbols are used as shown below.
The following illustration is for explanation purpose only, and should not be referred to as an actual documentation.

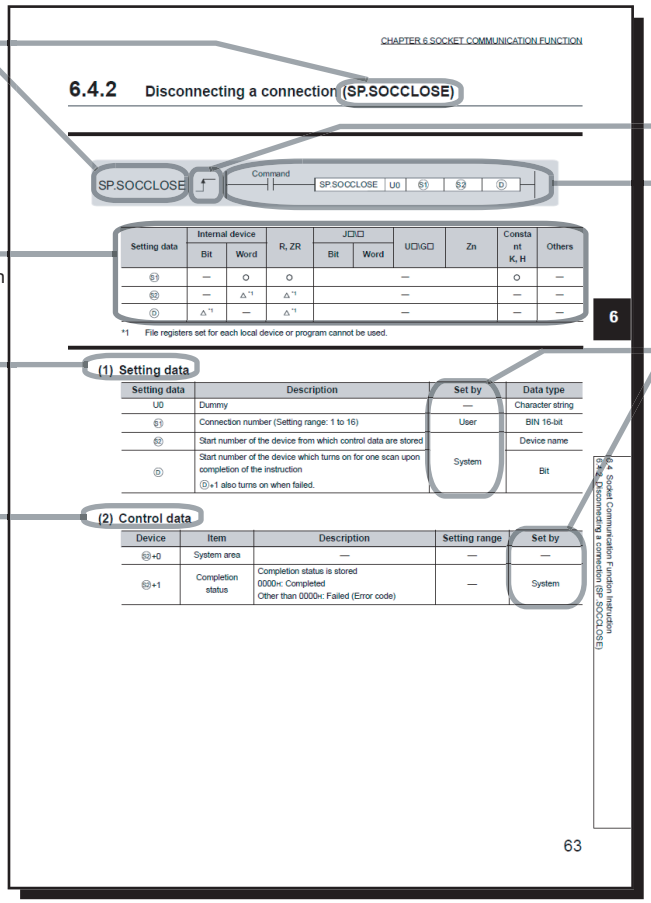

"" is used for screen names and items.
1. shows operating procedures.
shows mouse operations.*1
[ ] is used for items in the menu bar and the project window.
Ex. shows setting or operating examples.
shows reference manuals.
shows reference pages.
CHAPTER 7 VARIOUS SETTINGS
7.1.1 Setting method
(1) Setting parameters
(a) Operating procedure
1. Open the "PLC Parameter" dialog box.
Project window> [Parameter]> [PLC parameter]
2. Select the "I/O Assignment" tab.
Item
Description
Reference
Type
Model Name
Points
Start XY
Switch Setting
Detailed Setting
Set the following.
• Error Time Output Mode
• PLC Operation Mode at H/W Error
• I/O Response Time
Page 74, Section 7.1.2
Page 74, Section 7.1.3
Page 74, Section 7.1.4
Page 74, Section 7.1.5
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Setting "Start X/Y" enables modification on the start I/O numbers assigned to connected modules.
When "1000" is specified in "Start X/Y" to the slot where a 16-point module is connected, the assignment range of an input module is changed to X1000 to X100F.
For details, refer to the following.
MELSEC-L CPU Module User's Manual (Function Explanation, Program Fundamentals)
Point
Set the type of the connected module in "Type". Setting a different type results in "SP.UNIT LAY ERR.".
For the intelligent function module, the I/O points must also be the same in addition to the I/O assignment setting.
Page 30, Section 4.2.2)
Remark
When an intelligent module is connected, I/O assignment can be omitted by selecting connected modules from "Intelligent Function Module" in the Project window.
7
7.1 Setting Method
7.1.1 Setting method
73
The chapter of the current page is shown.
The section of the current page is shown.
Point shows notes that requires attention.
Remark shows useful information.

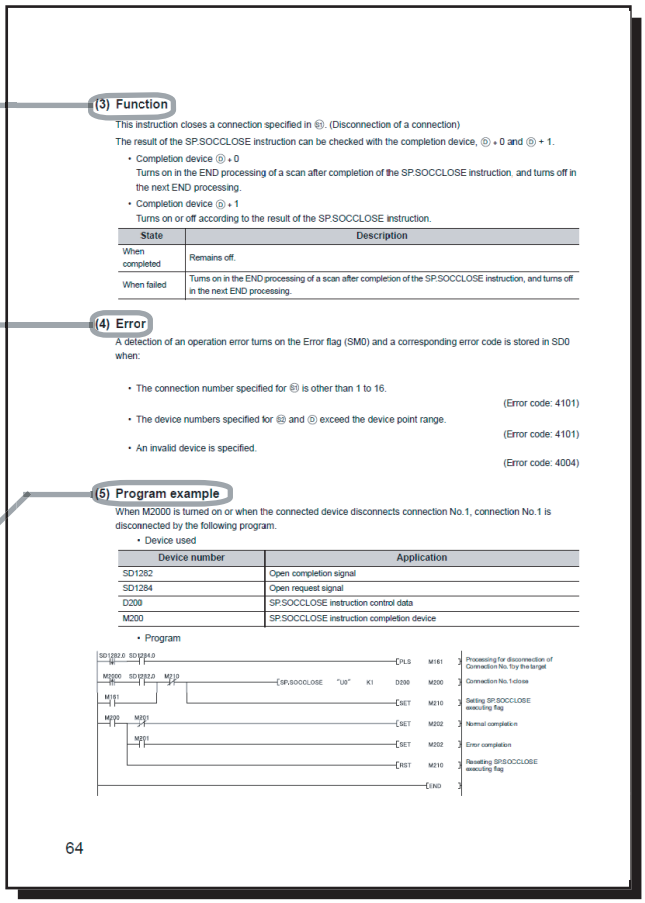
*1 The mouse operation example is provided below. (For GX Works2)


Menu bar
Ex. [Online] ⇨ [Write to PLC...]
Select [Online] on the menu bar, and then select [Write to PLC...].
A window selected in the view selection area is displayed.
Ex. Project window ⇨ [Parameter] ⇨ [PLC Parameter]
Select [Project] from the view selection area to open the Project window.
In the Project window, expand [Parameter] and select [PLC Parameter].
View selection area
MELSOFT Series GX Works2 (Unset Project) - [[PRG] MAIN]
Project Edit Find/Replace Compile View Online Debug Diagnos
Navigation
Project
Parameter
Intelligent Function Module
Global Device Comment
Program Setting
POU
Program
MAIN
Local Device Comment
Device Memory
Device Initial Value
Project
User Library
Connection Destination
[PRG] MAIN
Unlabeled

Pages describing instructions are organized as shown below.

The following illustration is for explanation purpose only, and should not be referred to as an actual documentation.




Detailed descriptions of the instruction
(3) Function
This instruction closes a connection specified in (S1). (Disconnection of a connection)
The result of the SP.SOCCLOSE instruction can be checked with the completion device, (D) + 0 and (D) + 1.
• Completion device (D) + 0
Turns on in the END processing of a scan after completion of the SP.SOCCLOSE instruction, and turns off in the next END processing.
• Completion device (D) + 1
Turns on or off according to the result of the SP.SOCCLOSE instruction.
State
Description
When completed
Remains off.
When failed
Turns on in the END processing of a scan after completion of the SP.SOCCLOSE instruction, and turns off in the next END processing.
Conditions for the error and error codes
For the errors not described in this manual, refer to the following.
MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)
(4) Error
A detection of an operation error turns on the Error flag (SM0) and a corresponding error code is stored in SD0 when:
• The connection number specified for (S1) is other than 1 to 16.
(Error code: 4101)
• The device numbers specified for (S2) and (D) exceed the device point range.
(Error code: 4101)
• An invalid device is specified.
(Error code: 4004)
Simple program example(s) and descriptions of the devices used
(5) Program example
When M2000 is turned on or when the connected device disconnects connection No.1, connection No.1 is disconnected by the following program.
• Device used
Device number
Application
SD1282
Open completion signal
SD1284
Open request signal
D200
SP.SOCCLOSE instruction control data
M200
SP.SOCCLOSE instruction completion device
• Program
SP.SOCCLOSE
"U0"
K1
D200
M200
M161
M210
M202
M201
END
64

• Instructions can be executed under the following conditions.

Execution condition	Any time	During on	On the rising edge	During off	On the falling edge
Symbol	No symbol				

• The following devices can be used.

Setting data	Internal device (system, user)		File register	Link direct device J□\□		Intelligent function module device U□\G□	Index register Zn	Constant *3	Others *3
	Bit	Word		Bit	Word				
Applicable device*1	X, Y, M, L, SM, F, B, SB, FX, FY*2	T, ST, C, D, W, SD, SW, FD, @□	R, ZR	-		U□\G□	Z	K, H, E, $	P, I, J, U, D, X, DY, N, BL, TR, BL\S, V

*1 For details on each device, refer to the following.

MELSEC-L CPU Module User's Manual (Function Explanation, Program Fundamentals)

*2 FX and FY can be used for bit data only, and FD for word data only.

*3 In the "Constant" and "Others" columns, a device(s) that can be set for each instruction is shown.

• The following data types can be used.

Data type	Description
Bit	Bit data or the start number of bit data
BIN 16-bit	16-bit binary data or the start number of word device
BIN 32-bit	32-bit binary data or the start number of double-word device
BCD 4-digit	Four-digit binary-coded decimal data
BCD 8-digit	Eight-digit binary-coded decimal data
Real number	Floating-point data
Character string	Character string data
Device name	Device name data

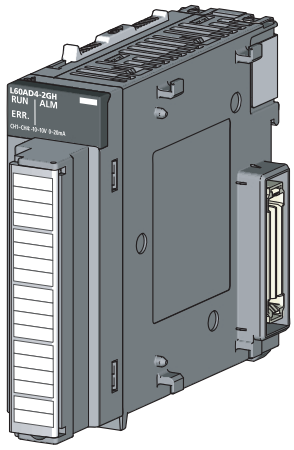
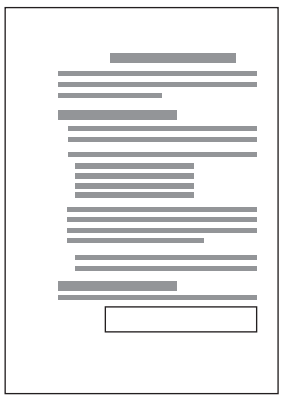
TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
A/D converter module	Another term for the MELSEC-L series dual channel isolated high resolution analog-digital converter module
Head module	The abbreviation for the LJ72GF15-T2 CC-Link IE field network head module
Display unit	A liquid crystal display to be attached to the CPU module
Programming tool	A generic term for GX Works2 and GX Developer
Factory default setting	A generic term for analog input ranges of 0 to 10V, 0 to 5V, 1 to 5V, -10 to 10V, 0 to 20mA, and 4 to 20mA
GX Works2	The product name of the software package for the MELSEC programmable controllers
GX Developer	
Buffer memory	A memory in an intelligent function module, where data (such as setting values and monitoring values) exchanged with a CPU module are stored.
FIR filter	The abbreviation for a finite impulse response filter. An FIR filter is a type of a digital filter.
Low pass filter	A filter that blocks out unnecessary high-frequency components in a signal
High pass filter	A filter that blocks out unnecessary low-frequency components in a signal
Band pass filter	A filter that passes only necessary frequency in a signal and blocks out the others
Pass band	Frequency bandwidth that passes through the filter without being attenuated
Attenuation band	Frequency bandwidth whose attenuation rate through the filter is in a transition state
Stop band	Frequency bandwidth attenuated by the filter
Pass band edge frequency	The boundary frequency between a pass band and an attenuation band
Trigger conversion request	A generic term for External trigger convert request (external input terminal) and Inside trigger conversion request (Un\G161)
Hold trigger	A request to stop logging

PACKING LIST

The following items are included in the package of this product. Before use, check that all the items are included.

L60AD4-2GH	
	
L60AD4-2GH	Before Using the Product

CHAPTER 1 A/D CONVERSION MODULE

This chapter describes the applications and features of the A/D converter module.

1.1 Application

This module converts analog values input from external devices to digital output values, and inputs the converted data to a CPU module. The CPU module can accept the digital output values from the conversion as information.

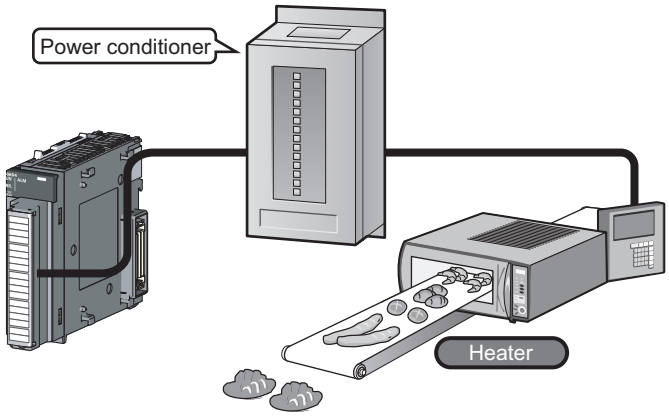


Analog signal (continuous signal)

Digital signal (discrete signal)

With the A/D converter module, the following application is possible.

Measuring the heat from a heater or other devices in the connection with a power conditioner



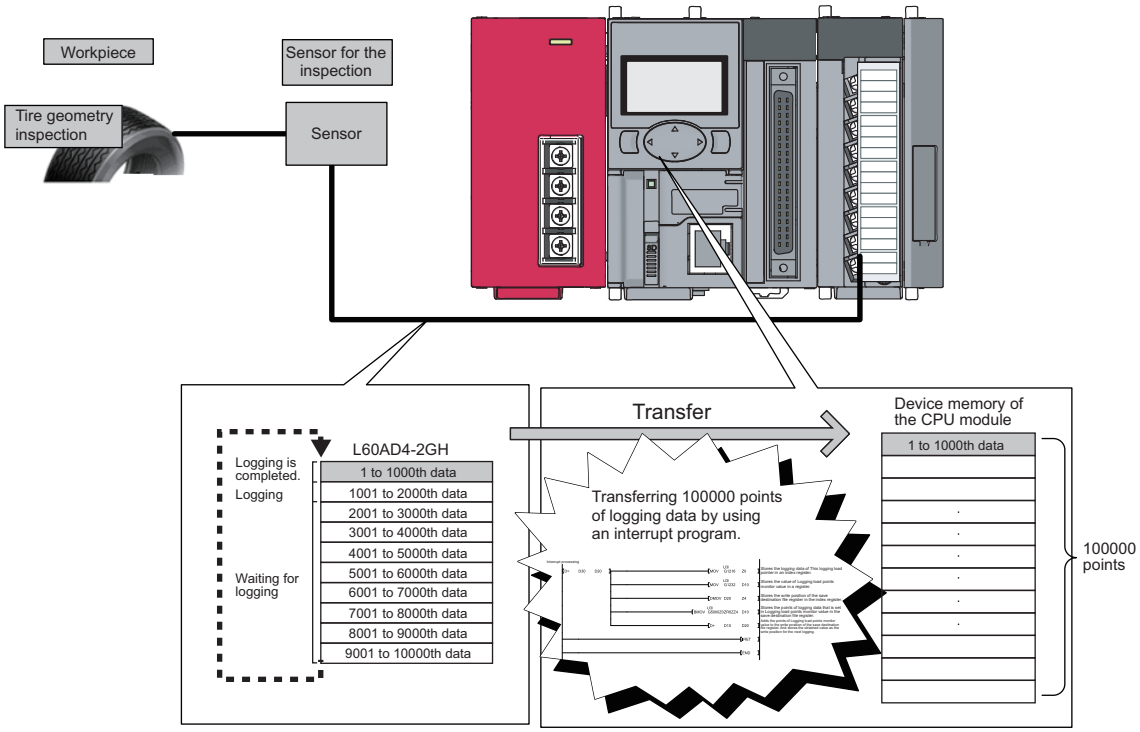
1.2 Features

1.2.1 Main features

(1) High-speed continuous logging

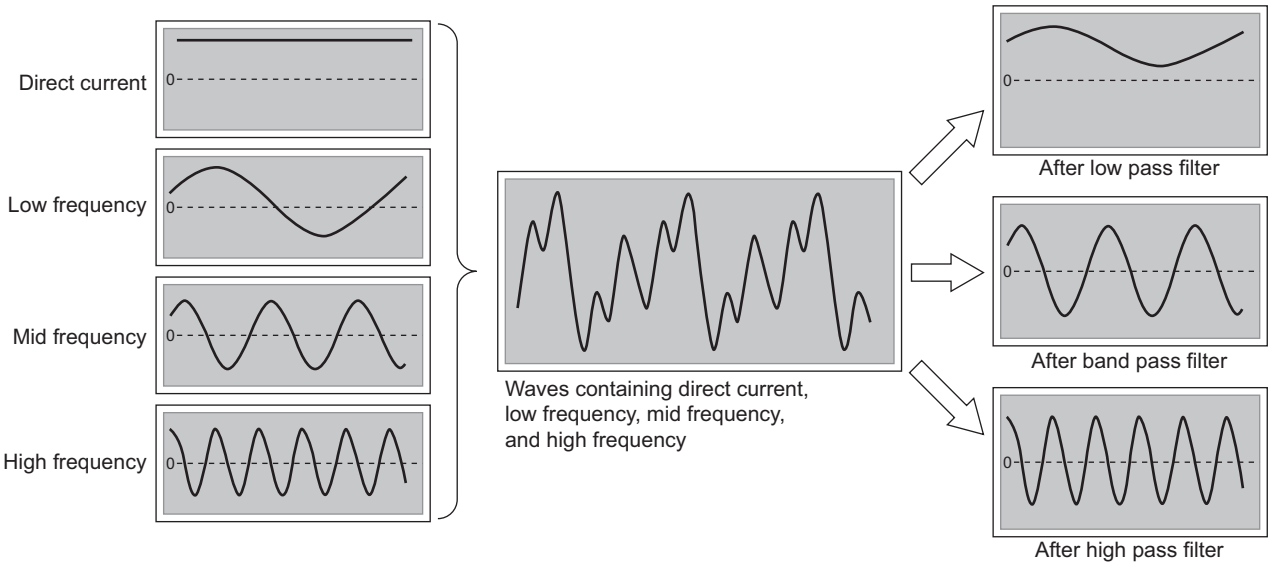
With the logging function, 10000 points of logging data of digital output values from A/D conversion can be collected through the high-speed continuous logging.

In addition, the logging load detection function enables the A/D converter module to transfer logging data stored in the buffer memory of the module to the file register of a CPU module without stopping the logging operation. The transfer enables more than 10000 points of logging data to be stored.



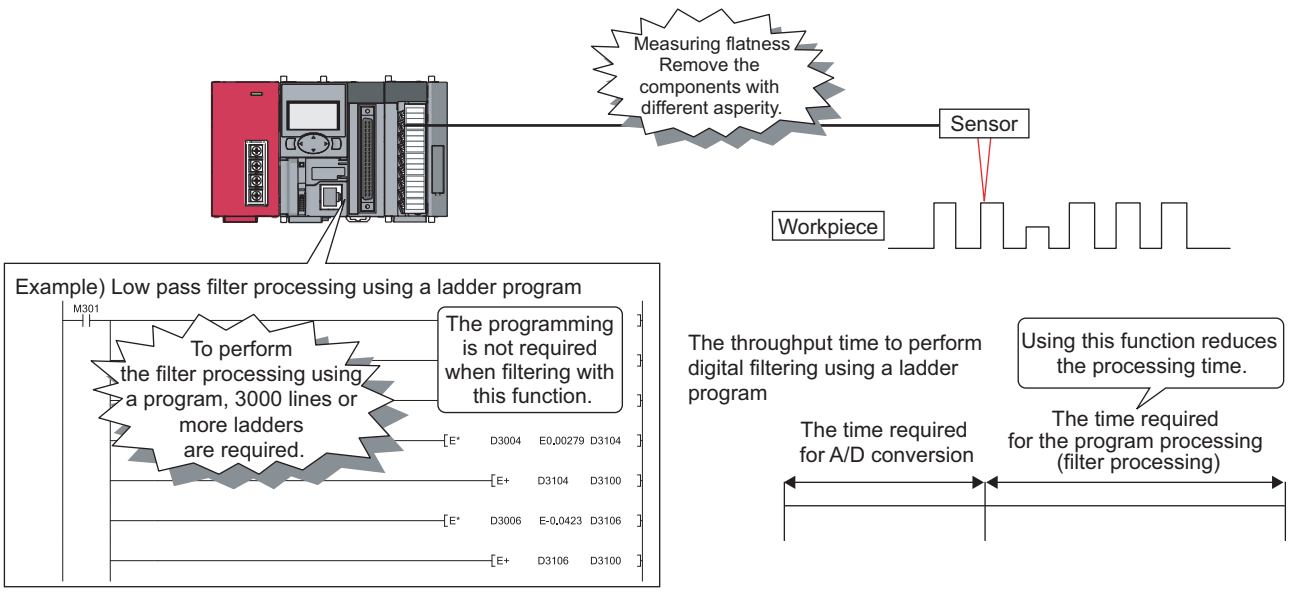
(2) Digital filtering function

Unnecessary components of a frequency in a signal can be removed. A low pass filter, a high pass filter, or a band pass filter can be selected as a digital filter.



Just setting parameters in the intelligent function module allows the function to be used, leading to reduced man-hours for programming.

A filtered A/D conversion value can be obtained at the same time as the A/D conversion is completed. Thus, the throughput time between A/D conversion completion and filter processing being started can be also reduced.


Measuring flatness
Remove the components with different asperity.
Sensor
Workpiece
Example) Low pass filter processing using a ladder program
M301
To perform the filter processing using a program, 3000 lines or more ladders are required.
The programming is not required when filtering with this function.
E+ D3004 E0.00279 D3104
E+ D3104 D3100
E+ D3006 E-0.0423 D3106
E+ D3106 D3100
The throughput time to perform digital filtering using a ladder program
Using this function reduces the processing time.
The time required for A/D conversion
The time required for the program processing (filter processing)

(a) Extracting target data

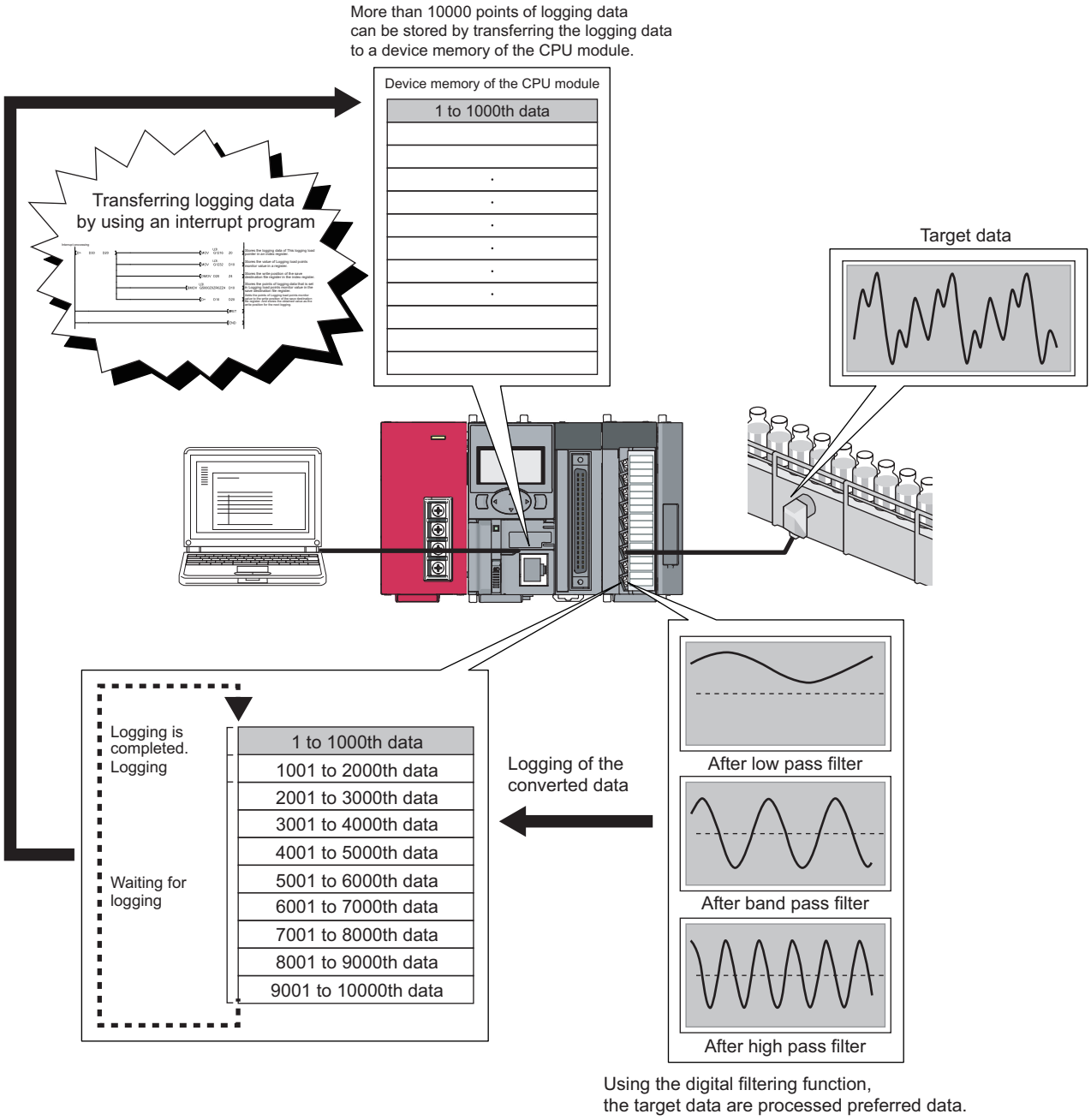
The combination of a test sensor and the A/D converter module can attenuate unnecessary frequency output from the test sensor. Noise is removed and thus target data can be obtained. (☞Page 80, Section 8.4 (5))

1.2.2 Advantages with the main features

Expensive devices for tests are not required by using the following functions of the module.

- Digital filtering function (low pass filter, high pass filter, band pass filter)
- Logging load detection function

The digital filtering function (low pass filter, high pass filter, band pass filter) removes noise by attenuating unnecessary frequency data. Thus, target frequency data is obtained through digital output values output from a test sensor.
The logging load detection function enables more than 10000 points of logging data of the obtained data to be stored continuously at high-speed conversion without stopping the logging operation.


More than 10000 points of logging data
can be stored by transferring the logging data
to a device memory of the CPU module.
Device memory of the CPU module
1 to 1000th data
Transferring logging data
by using an interrupt program
Target data
Logging is
completed.
Logging
Waiting for
logging
1 to 1000th data
1001 to 2000th data
2001 to 3000th data
3001 to 4000th data
4001 to 5000th data
5001 to 6000th data
6001 to 7000th data
7001 to 8000th data
8001 to 9000th data
9001 to 10000th data
Logging of the
converted data
After low pass filter
After band pass filter
After high pass filter
Using the digital filtering function,
the target data are processed preferred data.

1.2.3 Other features

(1) Detailed control by high resolution

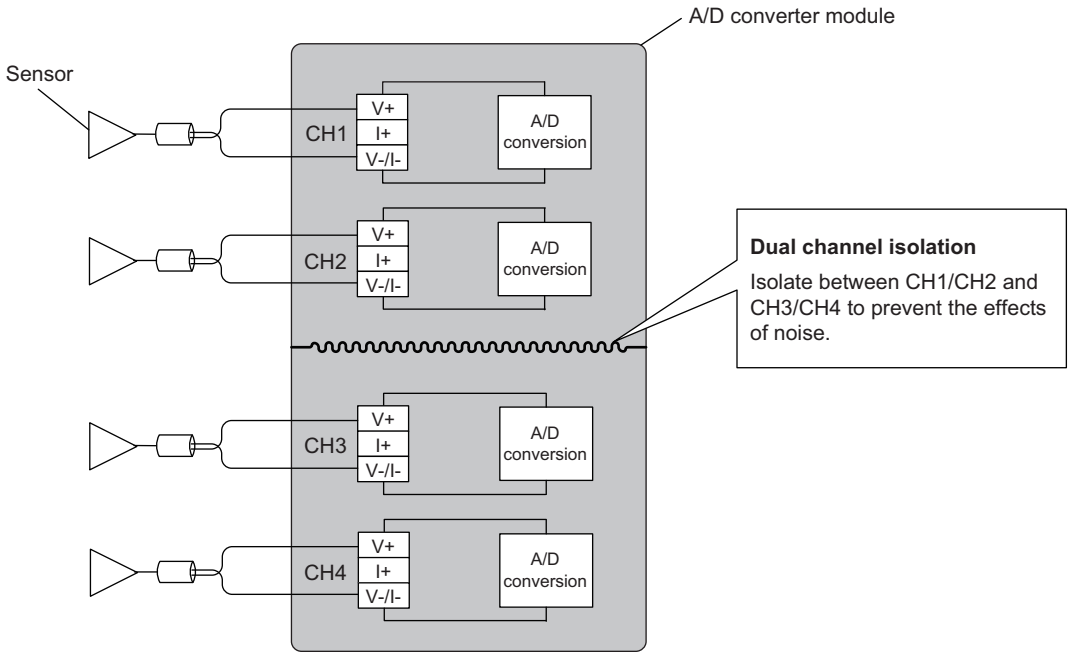
In all analog input ranges, the high resolution of 1/32000 is achieved.

(2) Reliability by high accuracy

The accuracy for the maximum value of the digital output value is ±0.05% (reference accuracy).

(3) Dual channel isolation

Four channels are divided into two groups of two and the two groups are isolated from each other. This prevents the effects of noise from other channels and the measurement becomes more stable.



(4) Operation of a digital output value by each function

The digital clipping function, scaling function, shift function, and difference conversion function can represent the digital output value in an easily understandable value according to the use environment.

(5) Comparing/monitoring target devices

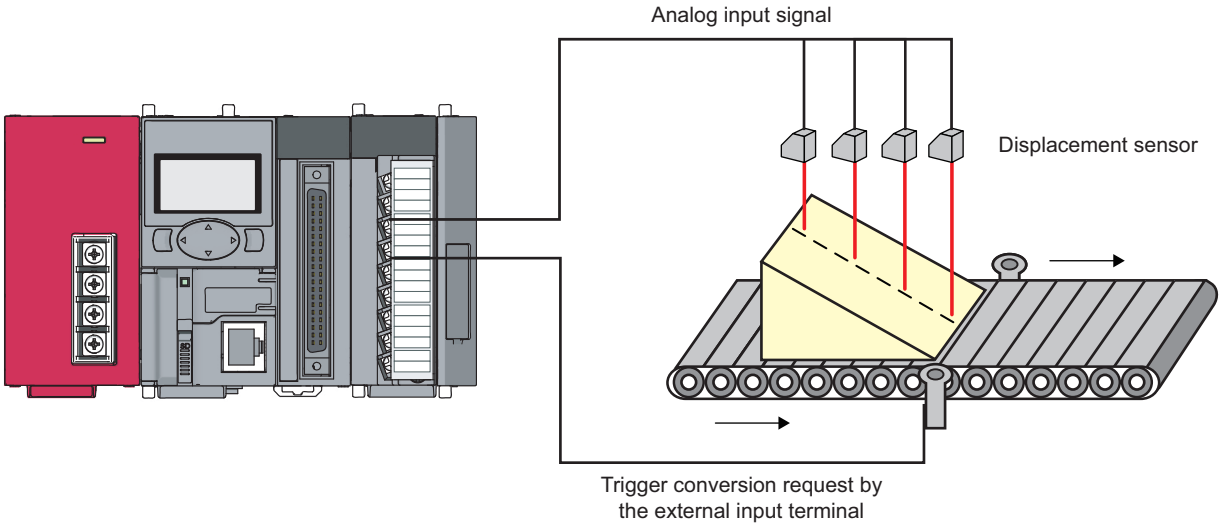
By using the input signal error detection function, input range extended mode function, or warning output function (process alarm, rate alarm), the status of connected devices can be monitored easily.

(6) Time lag filter function

With a time lag filter constant, a digital output value with smoothed noise is output. Man-hours for programming can be reduced.

(7) A/D conversion is possible at any timing

The conversion of analog values into digital values according to the input of Trigger conversion request is possible. The effectiveness of use, operation, and programming are improved.

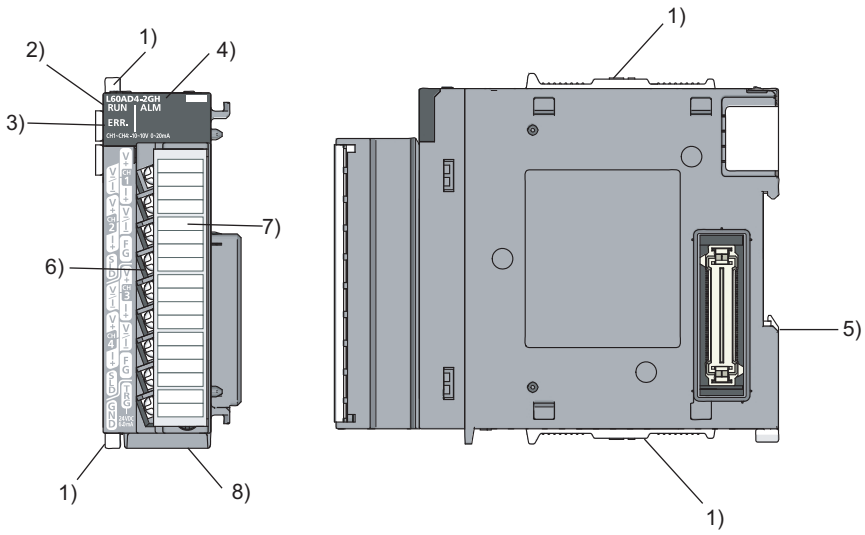


(8) Easy setting with GX Works2

Programming is reduced because the initial settings or auto refresh settings can be configured on the window. In addition, setting status and operation status of modules can be checked easily.

CHAPTER 2 PART NAMES

The following table shows part names of the A/D converter module.



Number	Name	Description
1)	Module joint levers	Levers for connecting modules
2)	RUN LED (green)	Indicates the operating status of the A/D converter module. ON: The module is operating normally. Flashing: In the offset/gain setting mode OFF: The 5V power off or watchdog timer error has occurred.
3)	ERR. LED (red)	Indicates the errors and status of the A/D converter module. ON: An error has occurred except for error code: 112*1 Flashing: Error code: 112 has occurred.*1 OFF: The module is operating normally.
4)	ALM LED (red)	Indicates the warning status of the A/D converter module. ON: Warning (process alarm or rate alarm) is occurring*2 Flashing: Input signal error detection is occurring*2 OFF: The module is operating normally.
5)	DIN rail hook	A hook used to mount the module to a DIN rail
6)	Terminal block	A 18-point screw terminal block for connecting input signal lines of external devices.
7)	Terminal block cover	A cover for preventing electric shock while the power is on
8)	Serial number display	Displays the serial number printed on the rating plate.

*1 For details, refer to Error Code List (Page 221, Section 11.4).

*2 For details, refer to Alarm Code List (Page 226, Section 11.5).

Memo

CHAPTER 3 SPECIFICATIONS

This chapter describes general specifications, performance specifications, function list, list of I/O signals, and list of buffer memory addresses.

3.1 General Specifications

For the general specifications of the A/D converter module, refer to the following.

The manual "Safety Guidelines" included with the CPU module or head module

3.2 Performance Specifications

The following table lists the performance specifications of the A/D converter module.

Item		Model
		L60AD4-2GH
Number of analog input points		4 points (4 channels)
Analog input	Voltage	-10 to 10VDC (input resistance 1M Ω)
	Current	0 to 20mADC (input resistance 250 Ω)
Digital output		-32000 to 32000
	When using the scaling function	-32768 to 32767

I/O characteristics, resolution[*1]

Analog input range		Digital output value	Maximum resolution
Voltage	0 to 10V	0 to 32000	312.5μV
	0 to 5V		156μV
	1 to 5V		125μV
	-10 to 10V	-32000 to 32000	312.5μV
	1 to 5V (Extended mode)	-8000 to 32000	125μV
	User range setting (bi-polar: voltage)	-32000 to 32000	200μV[*2]
Current	0 to 20mA	0 to 32000	625nA
	4 to 20mA		500nA
	4 to 20mA (Extended mode)	-8000 to 32000	500nA
	User range setting (uni-polar: current)	0 to 32000	400nA[*2]

Accuracy (accuracy for the maximum value of the digital output value)[*3]	Reference accuracy[*4]	Within ±0.05% (±16digit)
	Temperature coefficient[*5]	±40.1ppm/°C or lower
Conversion speed		40μ/2 channels
Absolute maximum input		Voltage: ±15V, Current: 30mA[*6]
Offset/gain setting count[*7]		Up to 100000 counts
Insulation method		Between I/O terminals and programmable controller power supply: photocoupler isolation Between analog input channels: dual channel transformer insulation
Dielectric withstand voltage		Between I/O terminals and programmable controller power supply: 500VAC for 1 minute Between analog input channels: 1000VAC for 1 minute
Insulation resistance		Between I/O terminals and programmable controller power supply: 500VDC 10M Ω or higher
Number of occupied I/O points		16 points (I/O assignment: 16 points for intelligent)
Connected terminal		18-point terminal block
Applicable wire size		0.3 to 0.75mm^2
Applicable solderless terminal		R1.25-3 (solderless terminals with sleeve are not usable)
Internal current consumption (5VDC)		0.76A
Weight		0.20kg

Item			Model
			L60AD4-2GH
Outside trigger input	Input points		1 point
	Rated input voltage		24VDC (+20%/-15%, ripple ratio: within 5%)
	Rated input current		6,0mA TYP. (at 24VDC)
	ON voltage/ON current		13V or higher/3mA or higher
	OFF voltage/OFF current		8V or lower/1.6mA or lower
	Input resistance		3.9k Ω
	Response time	OFF → ON	40μs
		ON → OFF	40μs

*1 For details on the I/O conversion characteristic, refer to the following.

I/O Conversion Characteristic of A/D Conversion (☞ Page 279, Appendix 3)

*2 Maximum resolution in the user range setting.

*3 Except when receiving noise influence.

*4 Accuracy under the ambient temperature when the offset/gain setting is performed.

*5 Accuracy when the temperature changes 1°C.

Ex. Accuracy when the temperature changes from 25°C to 30°C

0.05% + 0.00401%/°C (temperature coefficient) × 5°C (temperature change) = 0.070%

*6 A momentary input current value which does not cause damage to internal resistors of the module. The maximum input current value for constant application is 24mA.

*7 If the number of offset/gain settings exceeds 100000 times, an error occurs.

- The error code (170) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on.

3.2.1 Number of parameter settings

Set the initial settings of the A/D converter module and the parameter settings of the auto refresh setting so that the number of parameters, including those of other intelligent function modules, does not exceed the number of parameters that can be set in a CPU module.
For the maximum number of parameters that can be set in a CPU module (maximum number of parameter settings), refer to the following.

MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)

MELSEC-L CC-Link IE Field Network Head Module User's Manual

(1) Number of the A/D converter module's parameters

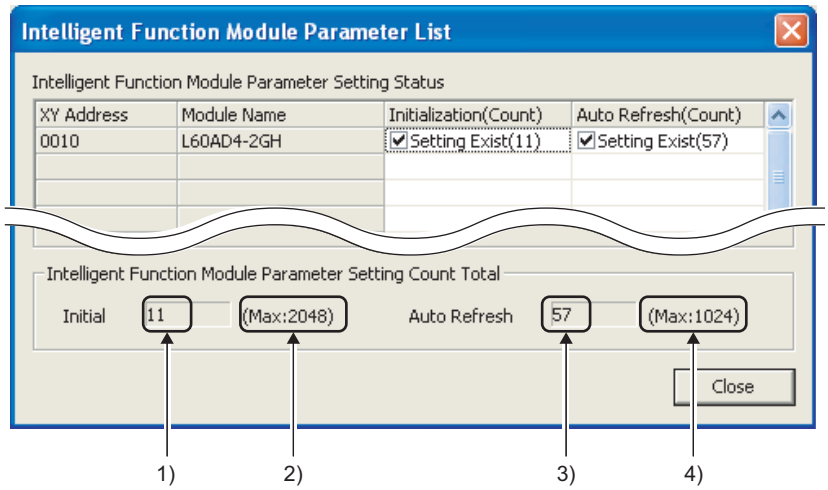
The following number of parameters can be set in a single A/D converter module.

Target module	Initial setting	Auto refresh setting
L60AD4-2GH	11	57

(2) Checking method

The maximum number of the parameter settings and the number of the parameter settings set for an intelligent function module can be checked with the following operation.

Project window ⇨ [Intelligent Function Module] ⇨ Right-click
⇨ [Intelligent Function Module Parameter List]



No.	Description
1)	The total number of the parameters in the initial settings selected on the window
2)	The maximum number of the parameter settings in the initial settings
3)	The total number of the parameters in the auto refresh settings selected on the window
4)	The maximum number of the parameter settings in the auto refresh settings

3.3 Function List

The following table lists the functions of the A/D converter module.

Item			Description	Reference
A/D conversion enable/disable function			Set whether to enable or disable A/D conversion for each channel. Disabling the A/D conversion for unused channels reduces the conversion cycles.	Page 73, Section 8.3
A/D conversion method	Sampling processing		The A/D converter module executes the A/D conversion of the analog input value sequentially and stores the digital output value to the buffer memory.	Page 76, Section 8.4 (2)
	Averaging processing	Time average	The A/D converter module executes the A/D conversion for set time, and stores the average of the total value excluding the maximum and the minimum values to the buffer memory. The number of processing time within the setting time changes depending on the number of channels used (the number of channels set to A/D conversion enabled).	Page 77, Section 8.4 (3) (a)
		Count average	The A/D converter module executes the A/D conversion for set time, and stores the average of the total value excluding the maximum and the minimum values to the buffer memory. Time for the count average value stored in the buffer memory changes depending on the used channel numbers (the number of channels set to A/D conversion enabled).	Page 77, Section 8.4 (3) (b)
		Moving average	The A/D converter module averages digital output values of set number of times which are measured every sampling cycle, and stores them in the buffer memory. Since the averaging processing is performed on a moving set of sampling processing, the latest digital output values can be obtained.	Page 78, Section 8.4 (3) (c)
	Time lag filter		The A/D converter module outputs averaged digital values with the time constant calculated by the setting value.	Page 79, Section 8.4 (4)
	Digital filter	Low pass filter	The A/D converter module outputs the digital value whose unnecessary high-frequency component in a signal is removed.	Page 80, Section 8.4 (5)
		High pass filter	The A/D converter module outputs the digital value whose unnecessary low-frequency component in a signal is removed.	
		Band pass filter	The A/D converter module passes only necessary frequency in a signal and outputs the digital value with the unnecessary frequency removed.	
Range switching function			The input range to use can be selected from the following ranges: • Industrial shipment setting (4 to 20mA, 0 to 20mA, 1 to 5V, 0 to 5V, -10 to 10V, 0 to 10V) • User range (User range setting (uni-polar: current)), User range setting (bi-polar: voltage)) • Extended mode range (4 to 20mA (Extended mode), 1 to 5V (Extended mode))	Page 57, Section 7.2
Offset/gain setting function			This function compensates for errors in digital output values.	Page 62, Section 7.5
Input range extended mode function			This function extends the input range. By combining this function with the input signal error detection function, simple disconnection detection can be executed.	Page 94, Section 8.5
Maximum value/minimum value hold function			The A/D converter module stores the maximum and minimum values of the digital operation values for each channel to the buffer memory. The maximum and minimum values of channels with the averaging processing specified are also stored to the buffer memory.	Page 95, Section 8.6

Item		Description	Reference
Input signal error detection function		This function detects the analog input value which exceeds the setting range. The upper lower limit detection, upper limit detection, lower limit detection, and disconnection detection can be executed.	Page 96, Section 8.7
Warning output function	Process alarm	This function outputs a warning when a digital operation value enters the preset range.	Page 102, Section 8.8.1
	Rate alarm	This function outputs a warning when a change rate of a digital output value exceeds the setting range.	Page 105, Section 8.8.2
Scaling function		This function enables scale conversion on the output digital values. The values are converted within the range of the set scaling upper limit value and scaling lower limit value. This omits the programming for scale conversion.	Page 110, Section 8.9
Shift function		This function adds the set shifting amount to conversion value to the digital operation value and stores the result in the buffer memory. Fine adjustment can be performed easily when the system starts.	Page 117, Section 8.10
Digital clipping function		When the input voltage or current exceeds the input range, the maximum value of the digital operation value can be set to 32000, and the minimum value can be set to 0 or -32000.	Page 122, Section 8.11
Difference conversion function		This function subtracts the difference conversion reference value from the digital operation value and stores the acquired value in the buffer memory.	Page 126, Section 8.12
Logging function		This function logs the digital output value or digital operation value. 10000 points of data can be logged for each channel. By combining this function with the logging load detection function, more than 10000 points of logging data can be obtained.	Page 130, Section 8.13
Trigger conversion function		This function converts analog values into digital values according to the input of Trigger conversion request. The method of the trigger conversion request can be selected from the following two types. • External trigger convert request by the external input terminal • Internal trigger conversion request by the buffer memory	Page 162, Section 8.14
Error log function		The function stores up to latest 16 errors and alarms that occurred in the A/D converter module to the buffer memory.	Page 170, Section 8.15
Module error collection function		This function collects errors and alarms that occurred in the A/D converter module and stores them to the CPU module.	Page 173, Section 8.16
Error clear function		This function clears the error from the system monitor when an error occurs.	Page 174, Section 8.17
Saving and restoring offset/gain values		The offset/gain value of the user range setting (uni-polar: current) and user range setting (bi-polar: voltage) can be saved or restored.	Page 175, Section 8.18

3.4 I/O Signal List

The following table lists the I/O signals of the A/D converter module.

For details on the I/O signals, refer to the following.

- Details of I/O Signals (☞Page 232, Appendix 1)

Input signal		Output signal	
Device number	**Signal name**	**Device number**	**Signal name**
X0	Module READY	Y0	Use prohibited
X1	Use prohibited	Y1	
X2		Y2	
X3		Y3	
X4		Y4	
X5		Y5	
X6		Y6	
X7		Y7	
X8	Warning output signal	Y8	
X9	Operating condition setting completed flag	Y9	Operating condition setting request
XA	Offset/gain setting mode flag	YA	User range write request
XB	Channel change completed flag	YB	Channel change request
XC	Input signal error detection signal	YC	Use prohibited
XD	Maximum value/ minimum value reset completed flag	YD	Maximum value/ minimum value reset request
XE	A/D conversion completed flag	YE	Use prohibited
XF	Error flag	YF	Error clear request

Point

- The I/O number (X/Y) described above shows the case that the start I/O number of the A/D converter module is set to "0".
- Do not use the "Use prohibited" signals shown above because the system uses them. If users use (turn on) the signals, the functions of the A/D converter module cannot be guaranteed.

3.5 List of Buffer Memory Addresses

The following table lists the buffer memory addresses of the A/D converter module.

For details on the buffer memory addresses, refer to the following.

• Details of Buffer Memory Addresses (☞Page 240, Appendix 2)

Point

Do not write data to the system area and the area where the data cannot be written from the program in the buffer memory. Writing data to these areas may lead the module to malfunction.

(1) Un\G0 to Un\G1799

Address (decimal)	Address (hexadecimal)	Name	Default*1	Read/Write*2
0	0_H	A/D conversion enable/disable setting	0000_H	R/W
1	1_H	CH1 Time Average/Count Average/ Moving Average/Time lag filter constant	0	R/W
2	2_H	CH2 Time Average/Count Average/ Moving Average/Time lag filter constant	0	R/W
3	3_H	CH3 Time Average/Count Average/ Moving Average/Time lag filter constant	0	R/W
4	4_H	CH4 Time Average/Count Average/ Moving Average/Time lag filter constant	0	R/W
5 to 8	5_H to 8_H	System area	–	–
9	9_H	Averaging process setting (for Q64AD)	0000_H	R/W
10	A_H	A/D conversion completed flag	0000_H	R
11	B_H	CH1 Digital output value	0	R
12	C_H	CH2 Digital output value	0	R
13	D_H	CH3 Digital output value	0	R
14	E_H	CH4 Digital output value	0	R
15 to 18	F_H to 12_H	System area	–	–
19	13_H	Latest error code	0	R
20	14_H	Setting range	0000_H	R
21	15_H	System area	–	–
22	16_H	Offset/gain setting mode Offset specification	0000_H	R/W
23	17_H	Offset/gain setting mode Gain specification	0000_H	R/W
24	18_H	Averaging process setting	0000_H	R/W
25	19_H	System area	–	–
26	$1A_H$			
27	$1B_H$	Input signal error detection setting	0000_H	R/W
28	$1C_H$	System area	–	–

Address (decimal)	Address (hexadecimal)	Name	Default*1	Read/Write*2
29	$1D_H$	Digital clipping enable/disable setting	$000F_H$	R/W
30	$1E_H$	CH1 Maximum value	0	R
31	$1F_H$	CH1 Minimum value	0	R
32	20_H	CH2 Maximum value	0	R
33	21_H	CH2 Minimum value	0	R
34	22_H	CH3 Maximum value	0	R
35	23_H	CH3 Minimum value	0	R
36	24_H	CH4 Maximum value	0	R
37	25_H	CH4 Minimum value	0	R
38 to 45	26_H to $2D_H$	System area	–	–
46	$2E_H$	Offset/gain range specification	0000_H	R/W
47	$2F_H$	System area	–	–
48	30_H	Warning output setting	$0F0F_H$	R/W
49	31_H	Input signal error detection flag	0000_H	R
50	32_H	Warning output flag (Process alarm)	0000_H	R
51	33_H	Warning output flag (Rate alarm)	0000_H	R
52	34_H	System area	–	–
53	35_H	Scaling enable/disable setting	$000F_H$	R/W
54	36_H	CH1 Digital operation value	0	R
55	37_H	CH2 Digital operation value	0	R
56	38_H	CH3 Digital operation value	0	R
57	39_H	CH4 Digital operation value	0	R
58 to 61	$3A_H$ to $3D_H$	System area	–	–
62	$3E_H$	CH1 Scaling lower limit value	0	R/W
63	$3F_H$	CH1 Scaling upper limit value	0	R/W
64	40_H	CH2 Scaling lower limit value	0	R/W
65	41_H	CH2 Scaling upper limit value	0	R/W
66	42_H	CH3 Scaling lower limit value	0	R/W
67	43_H	CH3 Scaling upper limit value	0	R/W
68	44_H	CH4 Scaling lower limit value	0	R/W
69	45_H	CH4 Scaling upper limit value	0	R/W
70 to 85	46_H to 55_H	System area	–	–
86	56_H	CH1 Process alarm lower lower limit value	0	R/W
87	57_H	CH1 Process alarm lower upper limit value	0	R/W
88	58_H	CH1 Process alarm upper lower limit value	0	R/W
89	59_H	CH1 Process alarm upper upper limit value	0	R/W

Address (decimal)	Address (hexadecimal)	Name	Default[*1]	Read/Write[*2]
90	$5A_H$	CH2 Process alarm lower lower limit value	0	R/W
91	$5B_H$	CH2 Process alarm lower upper limit value	0	R/W
92	$5C_H$	CH2 Process alarm upper lower limit value	0	R/W
93	$5D_H$	CH2 Process alarm upper upper limit value	0	R/W
94	$5E_H$	CH3 Process alarm lower lower limit value	0	R/W
95	$5F_H$	CH3 Process alarm lower upper limit value	0	R/W
96	60_H	CH3 Process alarm upper lower limit value	0	R/W
97	61_H	CH3 Process alarm upper upper limit value	0	R/W
98	62_H	CH4 Process alarm lower lower limit value	0	R/W
99	63_H	CH4 Process alarm lower upper limit value	0	R/W
100	64_H	CH4 Process alarm upper lower limit value	0	R/W
101	65_H	CH4 Process alarm upper upper limit value	0	R/W
102 to 117	66_H to 75_H	System area	–	–
118	76_H	CH1 Rate alarm detection cycle setting value	1	R/W
119	77_H	CH2 Rate alarm detection cycle setting value	1	R/W
120	78_H	CH3 Rate alarm detection cycle setting value	1	R/W
121	79_H	CH4 Rate alarm detection cycle setting value	1	R/W
122 to 125	$7A_H$ to $7D_H$	System area	–	–
126	$7E_H$	CH1 Rate alarm upper limit value	0	R/W
127	$7F_H$	CH1 Rate alarm lower limit value	0	R/W
128	80_H	CH2 Rate alarm upper limit value	0	R/W
129	81_H	CH2 Rate alarm lower limit value	0	R/W
130	82_H	CH3 Rate alarm upper limit value	0	R/W
131	83_H	CH3 Rate alarm lower limit value	0	R/W
132	84_H	CH4 Rate alarm upper limit value	0	R/W
133	85_H	CH4 Rate alarm lower limit value	0	R/W
134 to 141	86_H to $8D_H$	System area	–	–
142	$8E_H$	CH1 Input signal error detection setting value	50	R/W
143	$8F_H$	CH2 Input signal error detection setting value	50	R/W
144	90_H	CH3 Input signal error detection setting value	50	R/W
145	91_H	CH4 Input signal error detection setting value	50	R/W
146 to 149	92_H to 95_H	System area	–	–
150	96_H	CH1 Shifting amount to conversion value	0	R/W
151	97_H	CH2 Shifting amount to conversion value	0	R/W
152	98_H	CH3 Shifting amount to conversion value	0	R/W

Address (decimal)	Address (hexadecimal)	Name	Default*1	Read/Write*2
153	99_H	CH4 Shifting amount to conversion value	0	R/W
154 to 157	$9A_H$ to $9D_H$	System area	–	–
158	$9E_H$	Mode switching setting	0	R/W
159	$9F_H$			
160	$A0_H$	A/D conversion timing monitor value	0	R
161	$A1_H$	Inside trigger conversion request	0	R/W
162	$A2_H$	Trigger conversion completed flag	0	R
163	$A3_H$	Trigger conversion completed clear request	0	R/W
164 to 171	$A4_H$ to AB_H	System area	–	–
172	AC_H	CH1 Difference conversion trigger	0	R/W
173	AD_H	CH2 Difference conversion trigger	0	R/W
174	AE_H	CH3 Difference conversion trigger	0	R/W
175	AF_H	CH4 Difference conversion trigger	0	R/W
176 to 179	$B0_H$ to $B3_H$	System area	–	–
180	$B4_H$	CH1 Difference conversion reference value	0	R
181	$B5_H$	CH2 Difference conversion reference value	0	R
182	$B6_H$	CH3 Difference conversion reference value	0	R
183	$B7_H$	CH4 Difference conversion reference value	0	R
184 to 189	$B8_H$ to BD_H	System area	–	–
190	BE_H	CH1 Difference conversion status flag	0	R
191	BF_H	CH2 Difference conversion status flag	0	R
192	$C0_H$	CH3 Difference conversion status flag	0	R
193	$C1_H$	CH4 Difference conversion status flag	0	R
194 to 199	$C2_H$ to $C7_H$	System area	–	–
200	$C8_H$	Pass data classification setting	0000_H	R/W
201	$C9_H$	System area	–	–
202	CA_H	CH1 Industrial shipment setting offset value (L)	0	R/W
203	CB_H	CH1 Industrial shipment setting offset value (H)	0	R/W
204	CC_H	CH1 Industrial shipment setting gain value (L)	0	R/W
205	CD_H	CH1 Industrial shipment setting gain value (H)	0	R/W
206	CE_H	CH2 Industrial shipment setting offset value (L)	0	R/W
207	CF_H	CH2 Industrial shipment setting offset value (H)	0	R/W
208	$D0_H$	CH2 Industrial shipment setting gain value (L)	0	R/W

Address (decimal)	Address (hexadecimal)	Name	Default[*1]	Read/Write[*2]
209	$D1_H$	CH2 Industrial shipment setting gain value (H)	0	R/W
210	$D2_H$	CH3 Industrial shipment setting offset value (L)	0	R/W
211	$D3_H$	CH3 Industrial shipment setting offset value (H)	0	R/W
212	$D4_H$	CH3 Industrial shipment setting gain value (L)	0	R/W
213	$D5_H$	CH3 Industrial shipment setting gain value (H)	0	R/W
214	$D6_H$	CH4 Industrial shipment setting offset value (L)	0	R/W
215	$D7_H$	CH4 Industrial shipment setting offset value (H)	0	R/W
216	$D8_H$	CH4 Industrial shipment setting gain value (L)	0	R/W
217	$D9_H$	CH4 Industrial shipment setting gain value (H)	0	R/W
218	DA_H	CH1 User range setting offset value (L)	0	R/W
219	DB_H	CH1 User range setting offset value (H)	0	R/W
220	DC_H	CH1 User range setting gain value (L)	0	R/W
221	DD_H	CH1 User range setting gain value (H)	0	R/W
222	DE_H	CH2 User range setting offset value (L)	0	R/W
223	DF_H	CH2 User range setting offset value (H)	0	R/W
224	$E0_H$	CH2 User range setting gain value (L)	0	R/W
225	$E1_H$	CH2 User range setting gain value (H)	0	R/W
226	$E2_H$	CH3 User range setting offset value (L)	0	R/W
227	$E3_H$	CH3 User range setting offset value (H)	0	R/W
228	$E4_H$	CH3 User range setting gain value (L)	0	R/W
229	$E5_H$	CH3 User range setting gain value (H)	0	R/W
230	$E6_H$	CH4 User range setting offset value (L)	0	R/W
231	$E7_H$	CH4 User range setting offset value (H)	0	R/W
232	$E8_H$	CH4 User range setting gain value (L)	0	R/W
233	$E9_H$	CH4 User range setting gain value (H)	0	R/W
234 to 299	EA_H to $12B_H$	System area	–	–
300	$12C_H$	CH1 LPF Pass band edge frequency	0	R/W
301	$12D_H$	CH2 LPF Pass band edge frequency	0	R/W
302	$12E_H$	CH3 LPF Pass band edge frequency	0	R/W
303	$12F_H$	CH4 LPF Pass band edge frequency	0	R/W
304 to 307	130_H to 133_H	System area	–	–
308	134_H	CH1 HPF Pass band edge frequency	0	R/W
309	135_H	CH2 HPF Pass band edge frequency	0	R/W
310	136_H	CH3 HPF Pass band edge frequency	0	R/W
311	137_H	CH4 HPF Pass band edge frequency	0	R/W
312 to 315	138_H to $13B_H$	System area	–	–

Address (decimal)	Address (hexadecimal)	Name	Default*1	Read/Write*2
316	$13C_H$	CH1 BPF Pass band edge frequency (Low)	0	R/W
317	$13D_H$	CH1 BPF Pass band edge frequency (High)	0	R/W
318	$13E_H$	CH2 BPF Pass band edge frequency (Low)	0	R/W
319	$13F_H$	CH2 BPF Pass band edge frequency (High)	0	R/W
320	140_H	CH3 BPF Pass band edge frequency (Low)	0	R/W
321	141_H	CH3 BPF Pass band edge frequency (High)	0	R/W
322	142_H	CH4 BPF Pass band edge frequency (Low)	0	R/W
323	143_H	CH4 BPF Pass band edge frequency (High)	0	R/W
324 to 331	144_H to $14B_H$	System area	–	–
332	$14C_H$	CH1 Attenuation band width	0	R/W
333	$14D_H$	CH2 Attenuation band width	0	R/W
334	$14E_H$	CH3 Attenuation band width	0	R/W
335	$14F_H$	CH4 Attenuation band width	0	R/W
336 to 999	150_H to $3E7_H$	System area	–	–
1000	$3E8_H$	CH1 Logging enable/disable setting	1	R/W
1001	$3E9_H$	CH2 Logging enable/disable setting	1	R/W
1002	$3EA_H$	CH3 Logging enable/disable setting	1	R/W
1003	$3EB_H$	CH4 Logging enable/disable setting	1	R/W
1004 to 1007	$3EC_H$ to $3EF_H$	System area	–	–
1008	$3F0_H$	CH1 Logging hold request	0	R/W
1009	$3F1_H$	CH2 Logging hold request	0	R/W
1010	$3F2_H$	CH3 Logging hold request	0	R/W
1011	$3F3_H$	CH4 Logging hold request	0	R/W
1012 to 1015	$3F4_H$ to $3F7_H$	System area	–	–
1016	$3F8_H$	CH1 Logging hold flag	0	R
1017	$3F9_H$	CH2 Logging hold flag	0	R
1018	$3FA_H$	CH3 Logging hold flag	0	R
1019	$3FB_H$	CH4 Logging hold flag	0	R
1020 to 1023	$3FC_H$ to $3FF_H$	System area	–	–
1024	400_H	CH1 Logging data setting	1	R/W
1025	401_H	CH2 Logging data setting	1	R/W
1026	402_H	CH3 Logging data setting	1	R/W
1027	403_H	CH4 Logging data setting	1	R/W

Address (decimal)	Address (hexadecimal)	Name	Default[*1]	Read/Write[*2]
1028 to 1031	404_H to 407_H	System area	–	–
1032	408_H	CH1 Logging cycle setting value	4	R/W
1033	409_H	CH2 Logging cycle setting value	4	R/W
1034	$40A_H$	CH3 Logging cycle setting value	4	R/W
1035	$40B_H$	CH4 Logging cycle setting value	4	R/W
1036 to 1039	$40C_H$ to $40F_H$	System area	–	–
1040	410_H	CH1 Logging cycle unit setting	1	R/W
1041	411_H	CH2 Logging cycle unit setting	1	R/W
1042	412_H	CH3 Logging cycle unit setting	1	R/W
1043	413_H	CH4 Logging cycle unit setting	1	R/W
1044 to 1047	414_H to 417_H	System area	–	–
1048	418_H	CH1 Logging points after trigger	5000	R/W
1049	419_H	CH2 Logging points after trigger	5000	R/W
1050	$41A_H$	CH3 Logging points after trigger	5000	R/W
1051	$41B_H$	CH4 Logging points after trigger	5000	R/W
1052 to 1055	$41C_H$ to $41F_H$	System area	–	–
1056	420_H	CH1 Hold trigger condition setting	0000_H	R/W
1057	421_H	CH2 Hold trigger condition setting	0000_H	R/W
1058	422_H	CH3 Hold trigger condition setting	0000_H	R/W
1059	423_H	CH4 Hold trigger condition setting	0000_H	R/W
1060 to 1063	424_H to 427_H	System area	–	–
1064	428_H	CH1 Trigger data	54	R/W
1065	429_H	CH2 Trigger data	55	R/W
1066	$42A_H$	CH3 Trigger data	56	R/W
1067	$42B_H$	CH4 Trigger data	57	R/W
1068 to 1071	$42C_H$ to $42F_H$	System area	–	–
1072	430_H	Level data 0	0	R/W
1073	431_H	Level data 1	0	R/W
1074	432_H	Level data 2	0	R/W
1075	433_H	Level data 3	0	R/W
1076	434_H	Level data 4	0	R/W

Address (decimal)	Address (hexadecimal)	Name		Default*1	Read/Write*2
1077	435_H	Level data 5		0	R/W
1078	436_H	Level data 6		0	R/W
1079	437_H	Level data 7		0	R/W
1080	438_H	Level data 8		0	R/W
1081	439_H	Level data 9		0	R/W
1082	$43A_H$	CH1 Trigger setting value		0	R/W
1083	$43B_H$	CH2 Trigger setting value		0	R/W
1084	$43C_H$	CH3 Trigger setting value		0	R/W
1085	$43D_H$	CH4 Trigger setting value		0	R/W
1086 to 1089	$43E_H$ to 441_H	System area		–	–
1090	442_H	CH1 Head pointer		0	R
1091	443_H	CH2 Head pointer		0	R
1092	444_H	CH3 Head pointer		0	R
1093	445_H	CH4 Head pointer		0	R
1094 to 1097	446_H to 449_H	System area		–	–
1098	$44A_H$	CH1 Latest pointer		0	R
1099	$44B_H$	CH2 Latest pointer		0	R
1100	$44C_H$	CH3 Latest pointer		0	R
1101	$44D_H$	CH4 Latest pointer		0	R
1102 to 1105	$44E_H$ to 451_H	System area		–	–
1106	452_H	CH1 Number of logging data		0	R
1107	453_H	CH2 Number of logging data		0	R
1108	454_H	CH3 Number of logging data		0	R
1109	455_H	CH4 Number of logging data		0	R
1110 to 1113	456_H to 459_H	System area		–	–
1114	$45A_H$	CH1 Trigger pointer		0	R
1115	$45B_H$	CH2 Trigger pointer		0	R
1116	$45C_H$	CH3 Trigger pointer		0	R
1117	$45D_H$	CH4 Trigger pointer		0	R
1118 to 1121	$45E_H$ to 461_H	System area		–	–
1122	462_H	CH1 Logging cycle monitor value	(s)	0	R
1123	463_H		(ms)	0	R
1124	464_H		(μs)	0	R

Address (decimal)	Address (hexadecimal)	Name			Default[*1]	Read/Write[*2]
1125	465_H	CH2 Logging cycle monitor value		(s)	0	R
1126	466_H			(ms)	0	R
1127	467_H			(μs)	0	R
1128	468_H	CH3 Logging cycle monitor value		(s)	0	R
1129	469_H			(ms)	0	R
1130	$46A_H$			(μs)	0	R
1131	$46B_H$	CH4 Logging cycle monitor value		(s)	0	R
1132	$46C_H$			(ms)	0	R
1133	$46D_H$			(μs)	0	R
1134 to 1153	$46E_H$ to 481_H	System area			–	–
1154	482_H	CH1 Trigger detection time	First two digits of the year	Last two digits of the year	0	R
1155	483_H		Month	Day	0	R
1156	484_H		Hour	Minute	0	R
1157	485_H		Second	Day of the week	0	R
1158	486_H	CH2 Trigger detection time	First two digits of the year	Last two digits of the year	0	R
1159	487_H		Month	Day	0	R
1160	488_H		Hour	Minute	0	R
1161	489_H		Second	Day of the week	0	R
1162	$48A_H$	CH3 Trigger detection time	First two digits of the year	Last two digits of the year	0	R
1163	$48B_H$		Month	Day	0	R
1164	$48C_H$		Hour	Minute	0	R
1165	$48D_H$		Second	Day of the week	0	R
1166	$48E_H$	CH4 Trigger detection time	First two digits of the year	Last two digits of the year	0	R
1167	$48F_H$		Month	Day	0	R
1168	490_H		Hour	Minute	0	R
1169	491_H		Second	Day of the week	0	R
1170 to 1199	492_H to $4AF_H$	System area			–	–
1200	$4B0_H$	CH1 Loading interrupt enable/disable setting			1	R/W
1201	$4B1_H$	CH2 Loading interrupt enable/disable setting			1	R/W
1202	$4B2_H$	CH3 Loading interrupt enable/disable setting			1	R/W

Address (decimal)	Address (hexadecimal)	Name	Default*1	Read/Write*2
1203	$4B3_H$	CH4 Loading interrupt enable/disable setting	1	R/W
1204 to 1207	$4B4_H$ to $4B7_H$	System area	–	–
1208	$4B8_H$	CH1 Logging load points setting value	1000	R/W
1209	$4B9_H$	CH2 Logging load points setting value	1000	R/W
1210	$4BA_H$	CH3 Logging load points setting value	1000	R/W
1211	$4BB_H$	CH4 Logging load points setting value	1000	R/W
1212 to 1215	$4BC_H$ to $4BF_H$	System area	–	–
1216	$4C0_H$	CH1 This logging load pointer	-1	R
1217	$4C1_H$	CH2 This logging load pointer	-1	R
1218	$4C2_H$	CH3 This logging load pointer	-1	R
1219	$4C3_H$	CH4 This logging load pointer	-1	R
1220 to 1223	$4C4_H$ to $4C7_H$	System area	–	–
1224	$4C8_H$	CH1 Last logging load pointer	-1	R
1225	$4C9_H$	CH2 Last logging load pointer	-1	R
1226	$4CA_H$	CH3 Last logging load pointer	-1	R
1227	$4CB_H$	CH4 Last logging load pointer	-1	R
1228 to 1231	$4CC_H$ to $4CF_H$	System area	–	–
1232	$4D0_H$	CH1 Logging load points monitor value	0	R
1233	$4D1_H$	CH2 Logging load points monitor value	0	R
1234	$4D2_H$	CH3 Logging load points monitor value	0	R
1235	$4D3_H$	CH4 Logging load points monitor value	0	R
1236 to 1799	$4D4_H$ to 707_H	System area	–	–

*1 The default value is a value set after power-on or after resetting the CPU module.

*2 This shows whether whether reading the data from or writing the data to the area with programs is possible.
R: Readable
W: Writable

(2) Error history (Un\G1800 to Un\G4999)

Address (decimal)	Address (hexadecimal)	Name				Default[*1]	Read/Write[*2]
1800	708_H	Latest address of error history				0	R
1801 to 1809	709_H to 711_H	System area				–	–
1810	712_H	No.1	Error code			0	R
1811	713_H		Error time	First two digits of the year	Last two digits of the year	0	R
1812	714_H			Month	Day	0	R
1813	715_H			Hour	Minute	0	R
1814	716_H			Second	Day of the week	0	R
1815 to 1819	717_H to $71B_H$		System area			–	–
1820 to 1829	$71C_H$ to 725_H	No.2	Same as No. 1				
1830 to 1839	726_H to $72F_H$	No.3	Same as No. 1				
1840 to 1849	730_H to 739_H	No.4	Same as No. 1				
1850 to 1859	$73A_H$ to 743_H	No.5	Same as No. 1				
1860 to 1869	744_H to $74D_H$	No.6	Same as No. 1				
1870 to 1879	$74E_H$ to 757_H	No.7	Same as No. 1				
1880 to 1889	758_H to 761_H	No.8	Same as No. 1				
1890 to 1899	762_H to $76B_H$	No.9	Same as No. 1				

Address (decimal)	Address (hexadecimal)	Name		Default*1	Read/Write*2
1900 to 1909	$76C_H$ to 775_H	No.10	Same as No. 1		
1910 to 1919	776_H to $77F_H$	No.11	Same as No. 1		
1920 to 1929	780_H to 789_H	No.12	Same as No. 1		
1930 to 1939	$78A_H$ to 793_H	No.13	Same as No. 1		
1940 to 1949	794_H to $79D_H$	No.14	Same as No. 1		
1950 to 1959	$79E_H$ to $7A7_H$	No.15	Same as No. 1		
1960 to 1969	$7A8_H$ to $7B1_H$	No.16	Same as No. 1		
1970 to 4999	$7B2_H$ to 1387_H	System area		–	–

*1 The default value is a value set after power-on or after resetting the CPU module.

*2 This shows whether whether reading the data from or writing the data to the area with programs is possible.
R: Readable
W: Writable

(3) Logging section (Un\G5000 to Un\G49999)

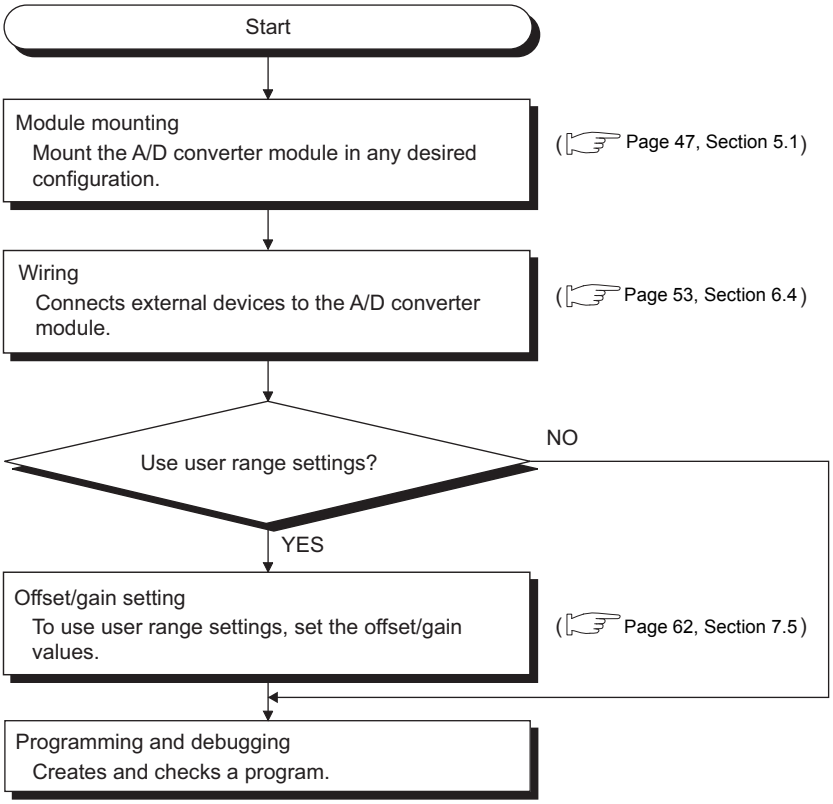
Address (decimal)	Address (hexadecimal)	Name	Default*1	Read/Write*2
5000 to 14999	1388_H to $3A97_H$	CH1 Logging data	0	R
15000 to 24999	$3A98_H$ to $61A7_H$	CH2 Logging data	0	R
25000 to 34999	$61A8_H$ to $88B7_H$	CH3 Logging data	0	R
35000 to 44999	$88B8_H$ to $AFC7_H$	CH4 Logging data	0	R
45000 to 49999	$AFC8_H$ to $C34F_H$	System area	–	–

*1 The default value is a value set after power-on or after resetting the CPU module.

*2 This shows whether whether reading the data from or writing the data to the area with programs is possible.
R: Readable
W: Writable

CHAPTER 4 PROCEDURES BEFORE OPERATION

This chapter describes the procedures before operation.


Start
Module mounting
Mount the A/D converter module in any desired configuration.
(☞ Page 47, Section 5.1)
Wiring
Connects external devices to the A/D converter module.
(☞ Page 53, Section 6.4)
Use user range settings?
NO
YES
Offset/gain setting
To use user range settings, set the offset/gain values.
(☞ Page 62, Section 7.5)
Programming and debugging
Creates and checks a program.

Memo

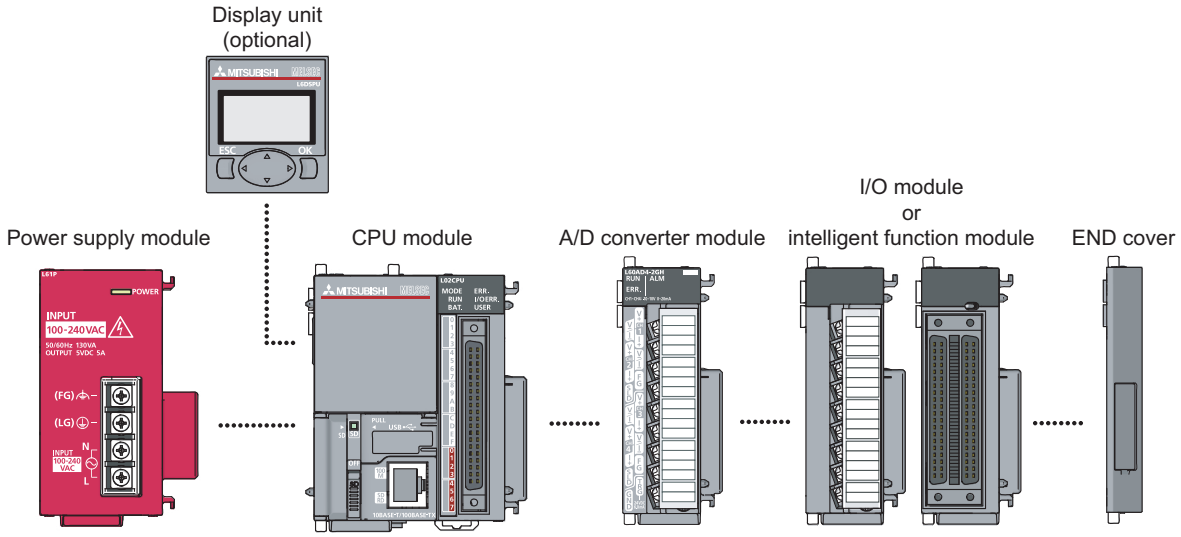
CHAPTER 5 SYSTEM CONFIGURATION

This chapter describes the overall configuration, number of connectable modules, and compatible software version of the A/D converter module.

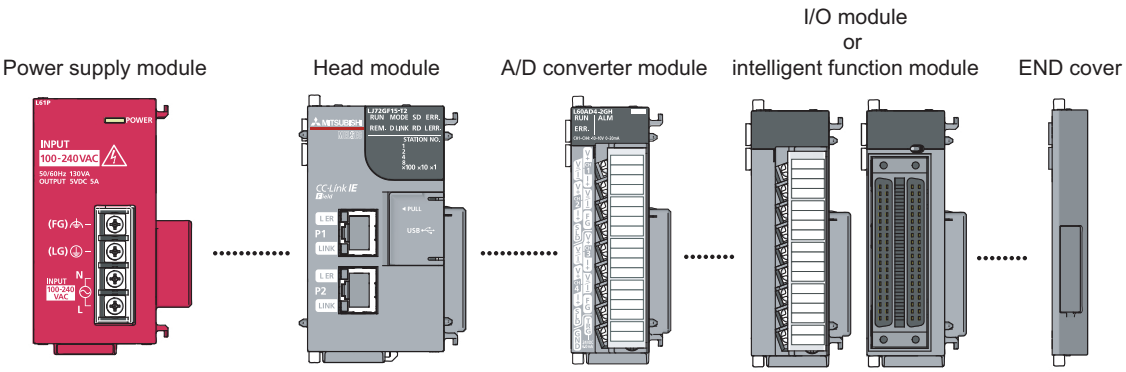
5.1 Overall System Configuration

The following figure shows system configuration examples for using the A/D converter module.

(1) When connected to a CPU module



(2) When connected to a head module



5.2 Applicable System

(1) Number of connectable modules

For the number of connectable modules, refer to the following.

MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)

MELSEC-L CC-Link IE Field Network Head Module User's Manual

(2) Compatible software version

For the compatible software versions, refer to the following.

Software	Version
GX Works2	Version 1.98C or later

5.3 Restrictions when the A/D Converter Module Is Connected to a Head Module

The following describes the restriction when the A/D converter module is connected to a head module.

- Dedicated instructions cannot be used.

CHAPTER 6 INSTALLATION AND WIRING

This chapter describes the installation and wiring of the A/D converter module.

6.1 Installation Environment and Installation Position

For precautions for installation environment and installation position, refer to the following.

MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)

MELSEC-L CC-Link IE Field Network Head Module User's Manual

6.2 Terminal Block

(1) Precautions

Tighten the terminal block screws within the following specified torque range.

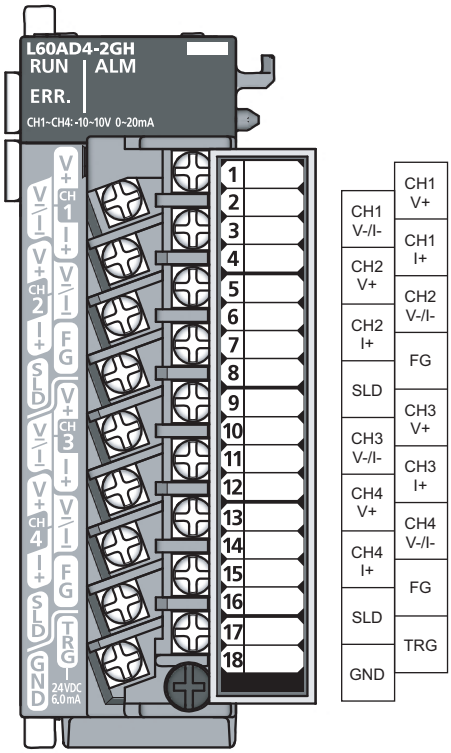
Screw type	Tightening torque range
Terminal screw (M3 screw)	0.42 to 0.58N • m
Terminal block mounting screw (M3.5 screw)	0.66 to 0.89N • m

The following table lists applicable solderless terminals connected to the terminal block. When wiring, use applicable wires and an appropriate tightening torque. Use UL-approved solderless terminals and, for processing, use a tool recommended by their manufacturer. Sleeved solderless terminals cannot be used.

Solderless terminal		Wire			
Model	Tightening torque	Diameter	Type	Material	Temperature rating
R1.25-3	0.42 to 0.58N • m	22 to 18 AWG	Stranded	Copper	75°C or more

(2) Signal names of the terminal block

The following table shows signal names of the terminal block.



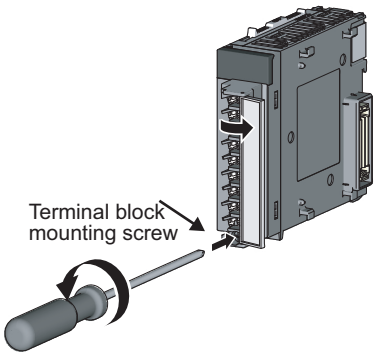
Pin number	Signal name	
1	CH1	V+
2		V-/I-
3		I+
4	CH2	V+
5		V-/I-
6		I+
7	FG	
8	SLD	
9	CH3	V+
10		V-/I-
11		I+
12	CH4	V+
13		V-/I-
14		I+
15	FG	
16	SLD	
17	TRG*1	
18	GND	

*1 The TRG terminal (an external input terminal) is used for both the logging outside trigger of the logging function and the external trigger conversion request (external input terminal) of the trigger conversion function.

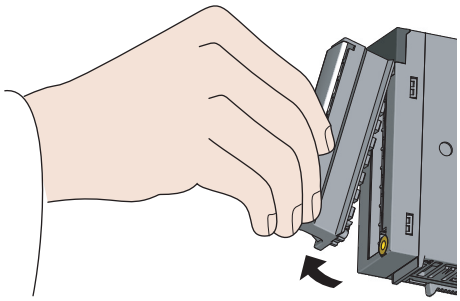
(3) Removal and installation of the terminal block

The following procedures show how to remove and install the terminal block.

(a) Removal procedure

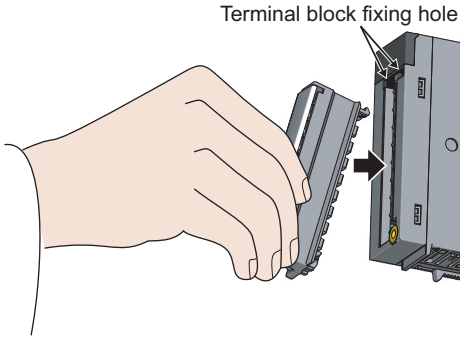


1. **Open the terminal cover and loosen the terminal block mounting screw.**

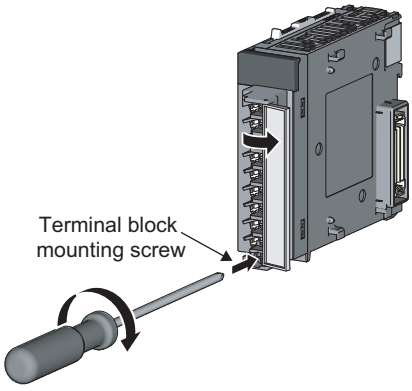


2. **Use the terminal block fixing holes as a fulcrum and remove the terminal block.**

(b) Installation procedure



1. **Fully insert the projections on the top of the terminal block into the terminal block fixing holes and press the terminal block until it snaps into place.**



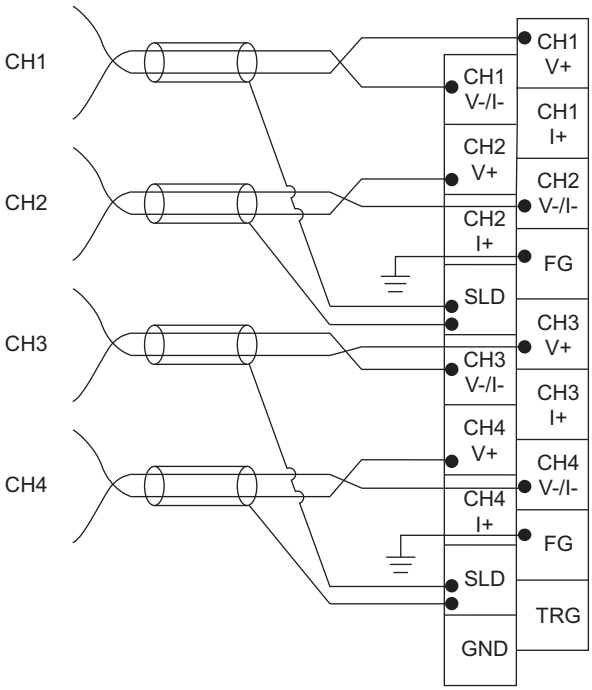
2. **Open the terminal cover and tighten the terminal block mounting screw.**

6.3 Wiring

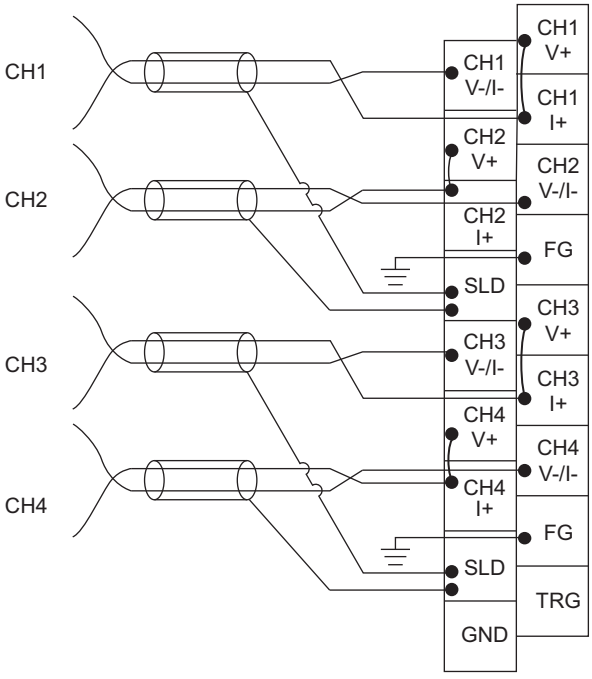
(1) Wiring to a terminal block

The following figures show wirings to a terminal block.

(a) For the voltage input



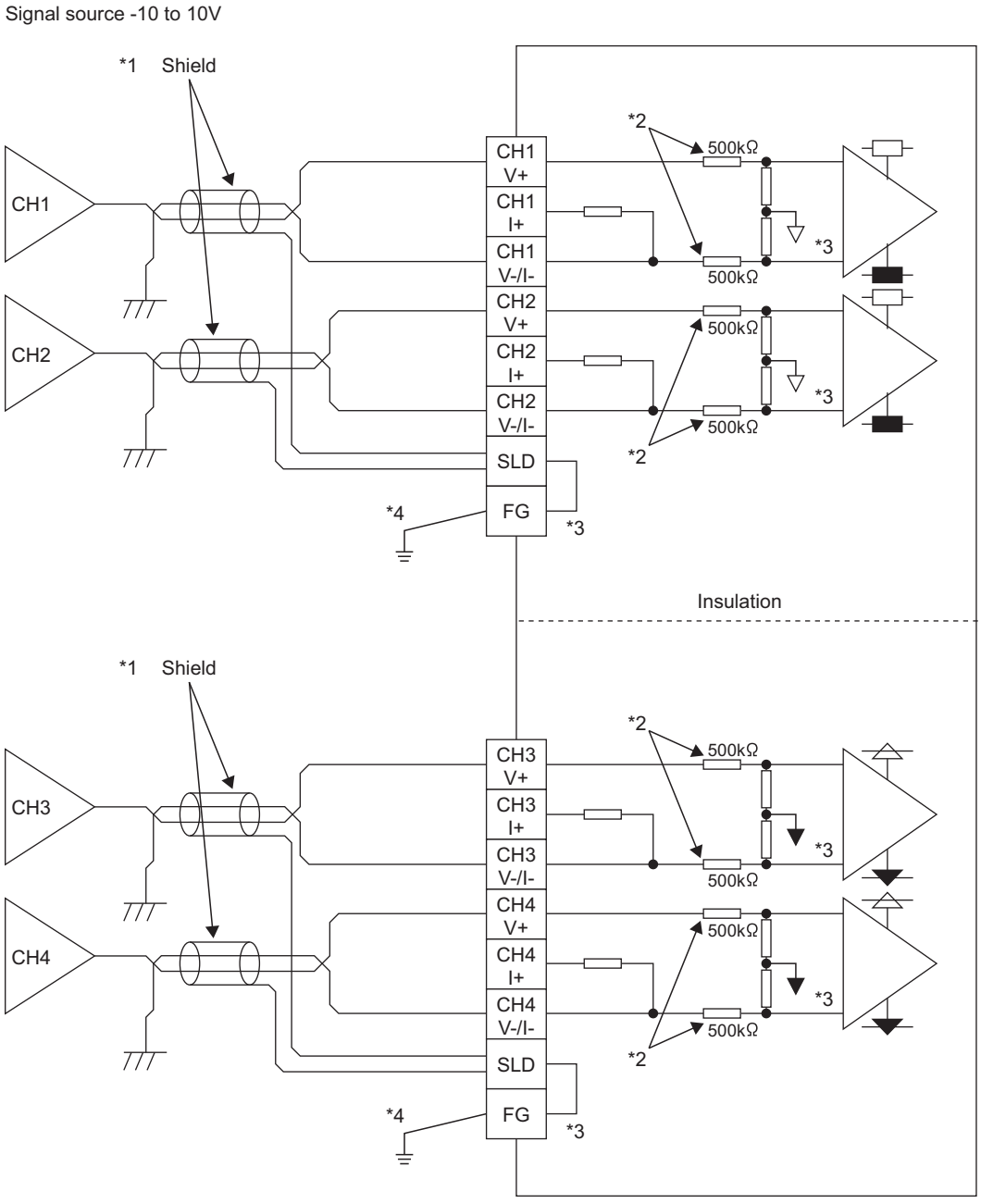
(b) For the current input



6.4 External Wiring

The following figures show the external wiring.

(1) For the voltage input



*1 For the wire, use the shielded twisted pair cable.
In addition, keep a distance of 150mm or more from the main circuit lines or power cables.

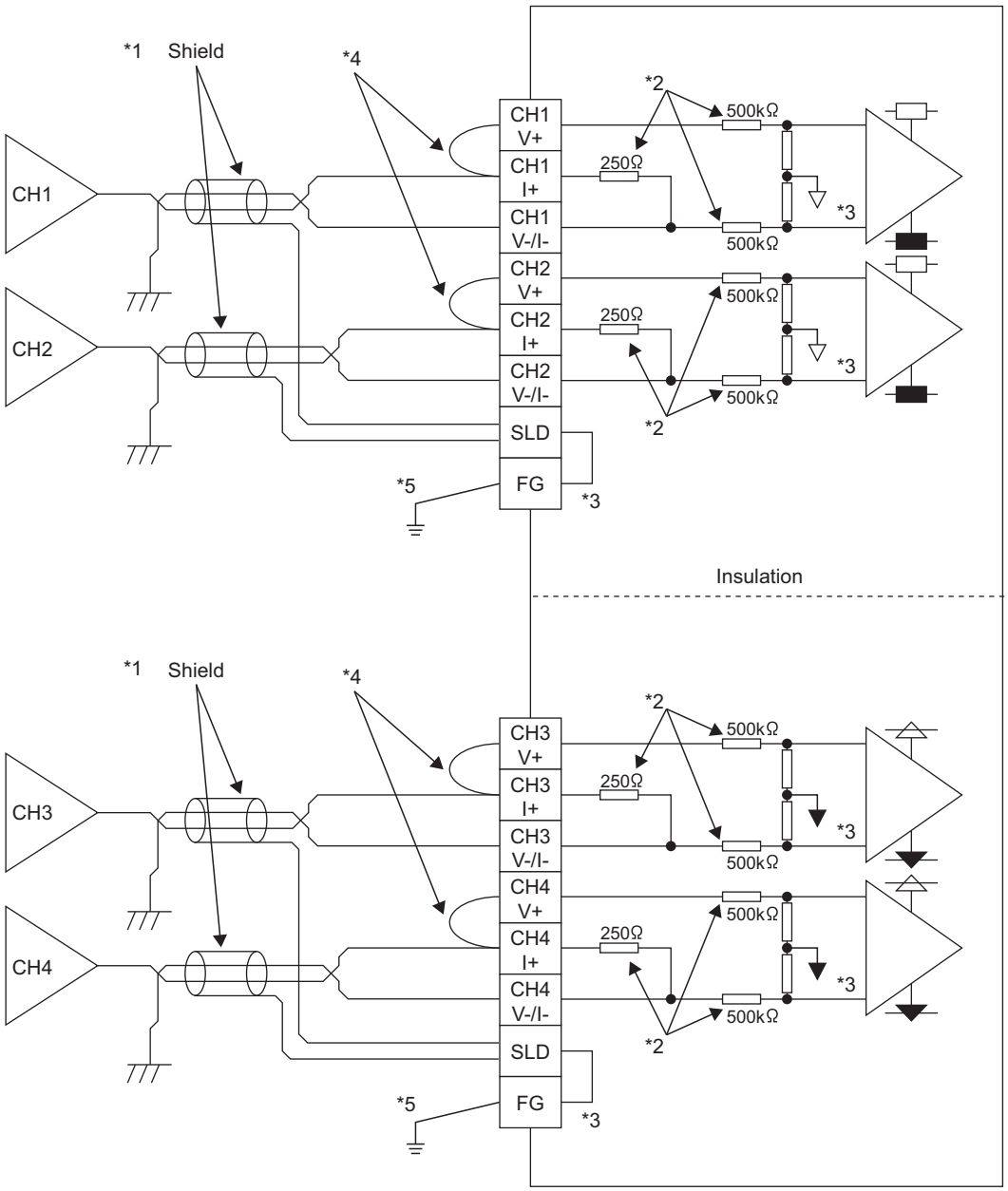
*2 This indicates the input resistance of the A/D converter module.

*3 The grounds of FG between CH1 and CH2, FG between CH3 and CH4, and the internal circuit have been isolated.

*4 Always connect the shielded wire for each channel to the shield terminal and ground the FG terminal.
In addition, ground the FG terminal of the power supply module.

(2) For the current input

Signal source 0 to 20mA



*1 For the wire, use the shielded twisted pair cable.
In addition, keep a distance of 150mm or more from the main circuit lines or power cables.

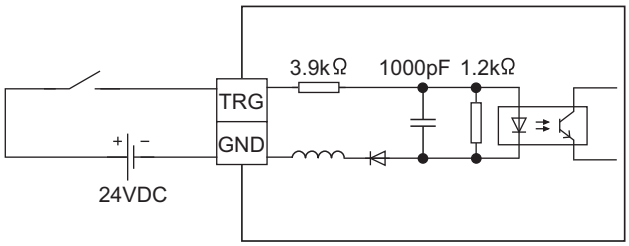
*2 This indicates the input resistance of the A/D converter module.

*3 The grounds of FG between CH1 and CH2, FG between CH3 and CH4, and the internal circuit have been isolated.

*4 For the current input, always connect the terminals (V+) and (I+).

*5 Always connect the shielded wire for each channel to the shield terminal and ground the FG terminal.
In addition, ground the FG terminal of the power supply module.

(3) Outside trigger input



(4) Precautions

In unused channels, if the circuit between two terminals is kept open, an undefined digital value may be output. To prevent this phenomenon, perform any of the following measures.

- Set the A/D conversion enable/disable setting in the unused channel to A/D conversion disable. Note that changing the A/D conversion enable/disable setting from A/D conversion enable to A/D conversion disable reduces the sampling cycle.
- Short-circuit the input terminals (V+) and (V-) of the unused channel.

CHAPTER 7 VARIOUS SETTINGS

This chapter describes the setting procedures of the A/D converter module.

Point

- After writing the setting of a new module, parameters, and auto refresh into the CPU module, reset the CPU module, switch STOP → RUN → STOP → RUN, or power off then on the module to validate the setting.
- After writing the switch setting to the CPU module, reset the CPU module or power off then on the module to validate the setting.

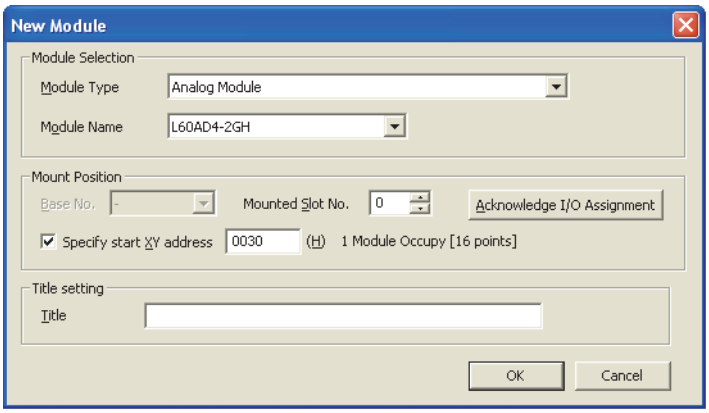
7.1 Addition of Modules

Add the model name of an A/D converter module to use on the project.

(1) Addition procedure

Open the "New Module" window.

Project window ⇨ [Intelligent Function Module] ⇨ Right-click ⇨ [New Module]



Item		Description
Module Selection	Module Type	Set "Analog Module".
	Module Name	Select the name of the module to be connected.
Mount Position	Mounted Slot No.	Set the slot No. where the module is connected.
	Specify start XY address	The start I/O number (hexadecimal) of the module is set according to the slot No. Setting any start I/O number is also possible.
Title setting	Title	Set any title.

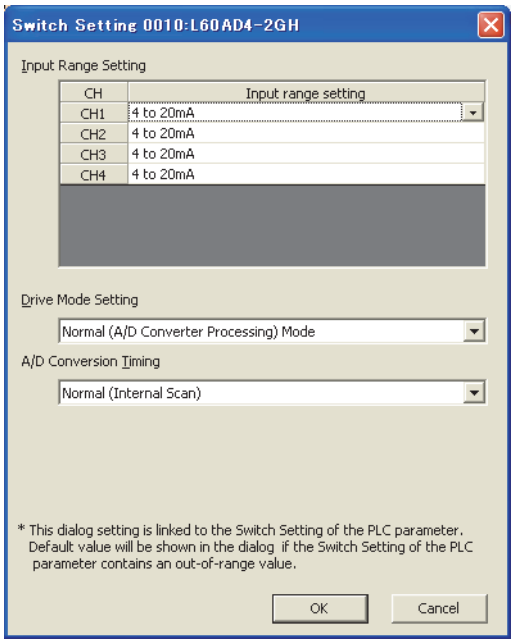
7.2 Switch Setting

Set the input range, operation mode, and A/D conversion timing used in each channel.

(1) Setting procedure

Open the "Switch Setting" window.

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Switch Setting]


Switch Setting 0010:L60AD4-2GH
Input Range Setting
CH
Input range setting
CH1
4 to 20mA
CH2
4 to 20mA
CH3
4 to 20mA
CH4
4 to 20mA
Drive Mode Setting
Normal (A/D Converter Processing) Mode
A/D Conversion Timing
Normal (Internal Scan)
* This dialog setting is linked to the Switch Setting of the PLC parameter. Default value will be shown in the dialog if the Switch Setting of the PLC parameter contains an out-of-range value.
OK
Cancel

Item	Description	Setting value
Input Range Setting	Set the input range used in each channel.	• 4 to 20mA (default value) • 0 to 20mA • 1 to 5V • 0 to 5V • -10 to 10V • 0 to 10V • 4 to 20mA (Extended Mode) • 1 to 5V (Extended Mode) • User Range Setting (Unipolar: Current) • User Range Setting (Bipolar: Voltage)
Drive Mode Setting	Set the operation mode of the A/D converter module.	• Normal (A/D Converter Processing) Mode (default value) • Offset-Gain Setting Mode
A/D Conversion Timing	Set the timing of the A/D conversion.	• Normal (Internal Scan) (default value) • External Trigger Convert Request (External Input Terminal) • Internal Trigger Conversion Request (Buffer Memory)

7.3 Parameter Setting

Set the parameters of each channel.

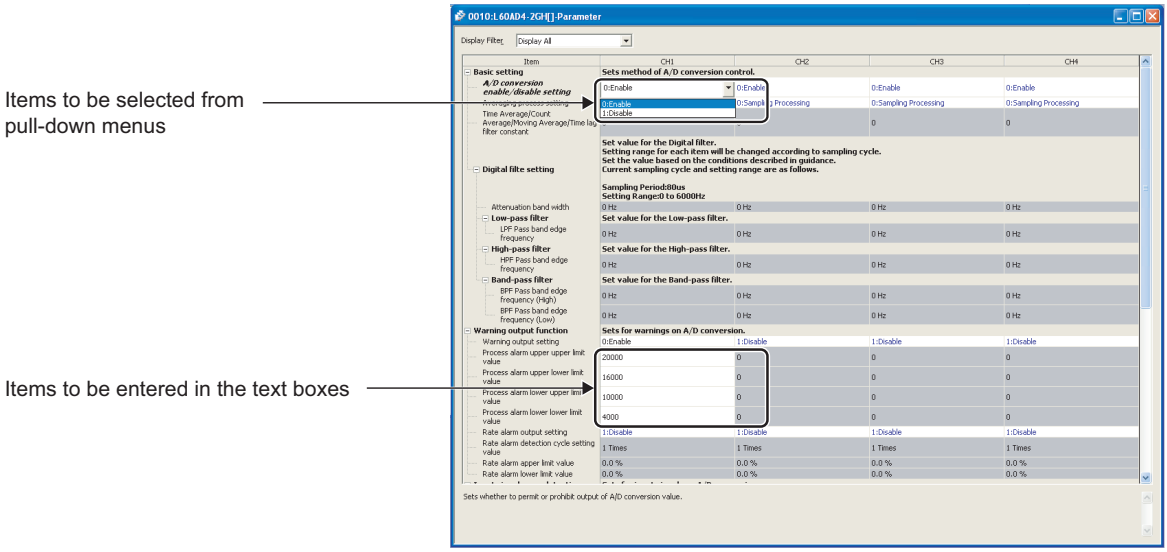
By setting the parameters, the setting by programming becomes unnecessary.

(1) Setting procedure

Open the "Parameter" window.

1. Start "Parameter".

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



2. Double-click the item to change the setting, and input the setting value.

- Items to be input from the pull-down list
  Double-click the item to be set to display the pull-down list. Select the item.
- Items to be input from the text box
  Double-click the item to be set, and input the setting value.

3. For setting CH2 to CH4, follow the operation of step 2.

Item		Setting value		Reference
Basic setting	A/D conversion enable/ disable setting	0: Enable (default value) 1: Disable		Page 73, Section 8.3
	Averaging process setting	0: Sampling Processing (default value) 1: Time Average 2: Count Average 3: Moving Average 4: Primary Delay Filter 5: Low Pass Filter 6: High Pass Filter 7: Band Pass Filter		Page 74, Section 8.4
	Time Average/Count Average/Moving Average/ Time lag filter constant	Time Average	2 to 5000ms (default value: 0)	
		Count Average	4 to 65000 times (default value: 0)	
		Moving Average	2 to 1000 times (default value: 0)	
		Primary Delay Filter	1 to 500 times (default value: 0)	

Item		Setting value		Reference
Digital filter setting	Attenuation band width	40μs: 330 to 12000Hz (default value: 0Hz) 80μs: 170 to 6000Hz (default value: 0Hz)		Page 74, Section 8.4
	Low-pass filter	LPF Pass band edge frequency	40μs: 0 to 12000Hz (default value: 0Hz) 80μs: 0 to 6000Hz (default value: 0Hz)	
	High-pass filter	HPF Pass band edge frequency	40μs: 0 to 12000Hz (default value: 0Hz) 80μs: 0 to 6000Hz (default value: 0Hz)	
	Band-pass filter	BPF Pass band edge frequency (High)	40μs: 0 to 12000Hz (default value: 0Hz) 80μs: 0 to 6000Hz (default value: 0Hz)	
		BPF Pass band edge frequency (Low)	40μs: 0 to 12000Hz (default value: 0Hz) 80μs: 0 to 6000Hz (default value: 0Hz)	
Warning output function	Warning output setting	0: Enable 1: Disable (default value)		Page 102, Section 8.8.1
	Process alarm upper upper limit value	-32768 to 32767 (default value: 0)		
	Process alarm upper lower limit value	-32768 to 32767 (default value: 0)		
	Process alarm lower upper limit value	-32768 to 32767 (default value: 0)		
	Process alarm lower lower limit value	-32768 to 32767 (default value: 0)		
	Rate alarm output setting	0: Enable 1: Disable (default value)		Page 105, Section 8.8.2
	Rate alarm detection cycle setting value	1 to 32000 Times (default value: 1 Times)		
	Rate alarm upper limit value	-3276.8 to 3276.7% (default value: 0.0%)		
	Rate alarm lower limit value	-3276.8 to 3276.7% (default value: 0.0%)		
Input signal error detection	Input signal error detection setting	0: Disable (default value) 1: Upper and Lower Detection 2: Lower Detection 3: Upper Detection 4: Disconnection Detection		Page 96, Section 8.7
	Input signal error detection setting value	0.0 to 25.0% (default value: 5.0%)		
Scaling function	Scaling enable/disable setting	0: Enable 1: Disable (default value)		Page 110, Section 8.9
	Scaling upper limit value	-32000 to 32000 (default value: 0)		
	Scaling lower limit value	-32000 to 32000 (default value: 0)		
Digital clipping function	Digital clipping function enable/ disable setting	0: Enable 1: Disable (default value)		Page 122, Section 8.11
Shift function	Shifting amount to conversion value	-32768 to 32767 (default value: 0)		Page 117, Section 8.10

Item		Setting value	Reference
Logging function	Logging enable/disable setting	0: Enable 1: Disable (default value)	Page 130, Section 8.13
	Logging data setting	0: Digital Output Value 1: Digital Operation Value (default value)	
	Logging cycle setting value	μs: 40 to 32767 (default value: 4) ms: 1 to 32767 (default value: 4) s: 1 to 3600 (default value: 4)	
	Logging cycle unit specification	0: μs 1: ms (default value) 2: s	
	Logging points after trigger	1 to 10000 (default value: 5000)	
	Hold trigger condition setting	0: Logging Hold Request (default value) 1: Level Trigger (Conditions: Rise) 2: Level Trigger (Conditions: Fall) 3: Level Trigger (Conditions: Rise/Fall) 4: External Trigger	
	Trigger data	0 to 4999 (CH1 default value: 54) (CH2 default value: 55) (CH3 default value: 56) (CH4 default value: 57)	
	Trigger setting value	-32768 to 32767 (default value: 0)	
	Loading interrupt enable/ disable setting	0: Enabled 1: Disabled (default value)	
	Logging load points setting value	10 to 10000 (default value: 1000)	

7.4 Auto Refresh

This function transfers data in the buffer memory to specified devices.
By the auto refresh setting, reading/writing data by programming becomes unnecessary.

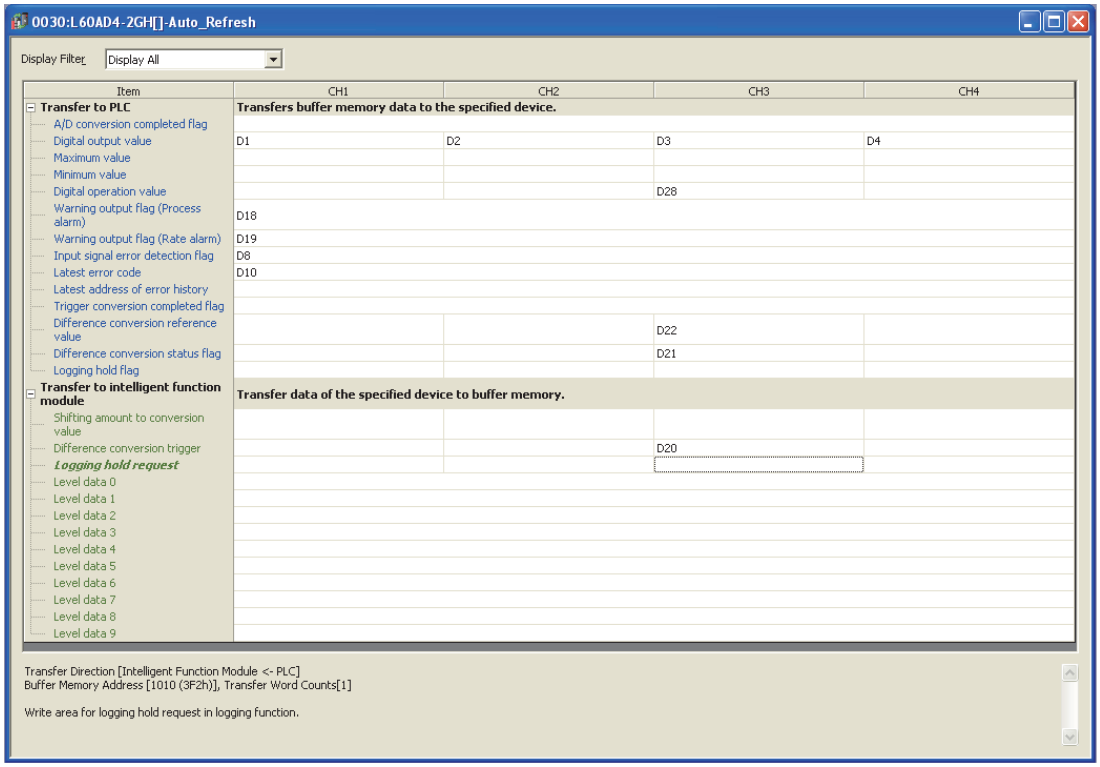
(1) Setting procedure

Open the "Auto_Refresh" window.

1. Start "Auto_Refresh".

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Auto_Refresh]

2. Click the item to be set, and input the auto refresh target device.



Point

Available devices are X, Y, M, L, B, T, C, ST, D, W, R, and ZR.
When a bit device X, Y, M, L, or B is used, set the number that is divisible by 16 points (example: X10, Y120, M16). Data in the buffer memory are stored in 16 points of devices from the set device No. (Example: When X10 is set, the data are stored in X10 to X1F.)

7.5 Offset/gain Setting

When using the user range setting (uni-polar: current) or user range setting (bi-polar: voltage), configure the offset/gain setting with the following operations.

When the industrial shipment setting is used, the offset/gain setting is not required.

The offset/gain setting can be configured by the following two types of operations.

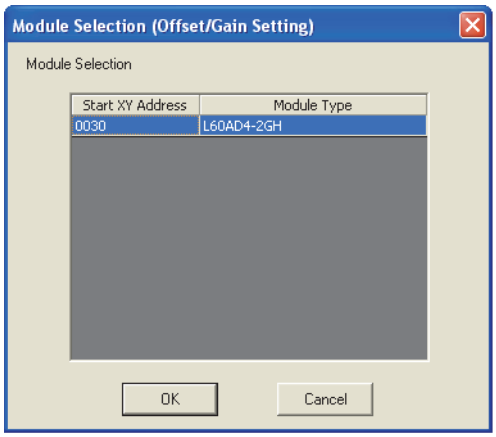
- Setting from "Offset/Gain Setting" of GX Works2
- Setting from a program

7.5.1 Setting from "Offset/Gain Setting" of GX Works2

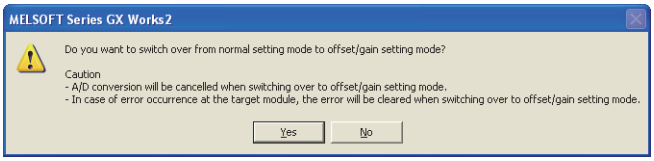
(1) Setting procedure

Open the "Offset/Gain Setting" window.

[Tool] ⇨ [Intelligent Function Module Tool] ⇨ [Analog Module] ⇨ [Offset/Gain Setting...]



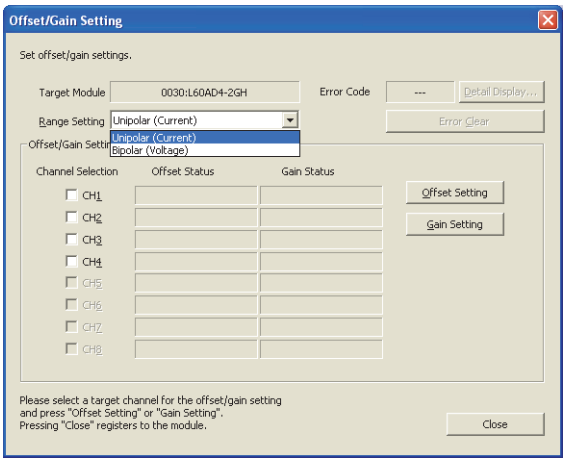
↓


MELSOFT Series GX Works2
Do you want to switch over from normal setting mode to offset/gain setting mode?
Caution
- A/D conversion will be cancelled when switching over to offset/gain setting mode.
- In case of error occurrence at the target module, the error will be cleared when switching over to offset/gain setting mode.
Yes
No

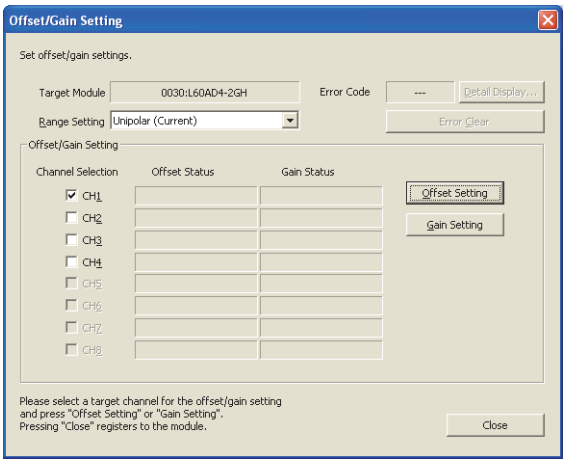
↓

1. **Select the module to configure the offset/gain setting, and click the OK button.**

2. **Click the Yes button.**

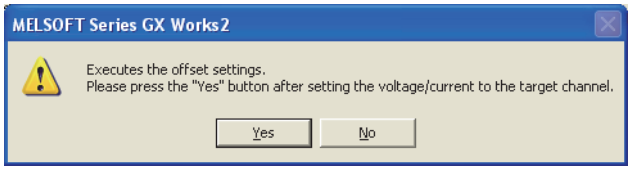


3. **Select Unipolar (Current) or Bipolar (Voltage) in "Range Setting".**



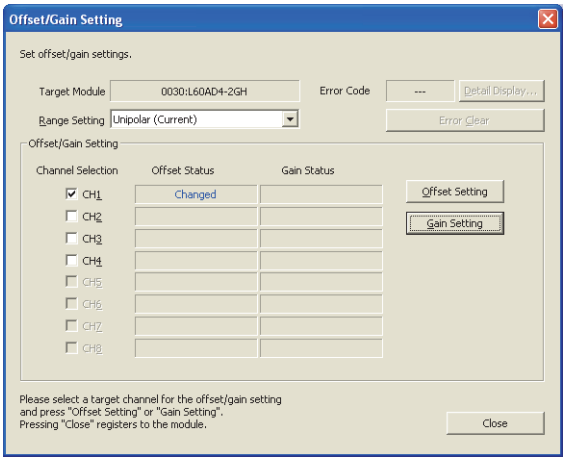
4. **Select the channel to use the offset/gain setting, and click the** Offset Setting **button.**

↓


MELSOFT Series GX Works2
Executes the offset settings.
Please press the "Yes" button after setting the voltage/current to the target channel.
Yes
No

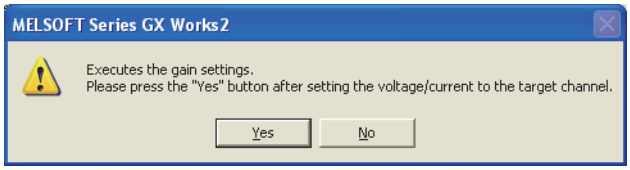
5. **Input the offset value voltage or current in the target channel terminal, and click the** Yes **button.**

↓

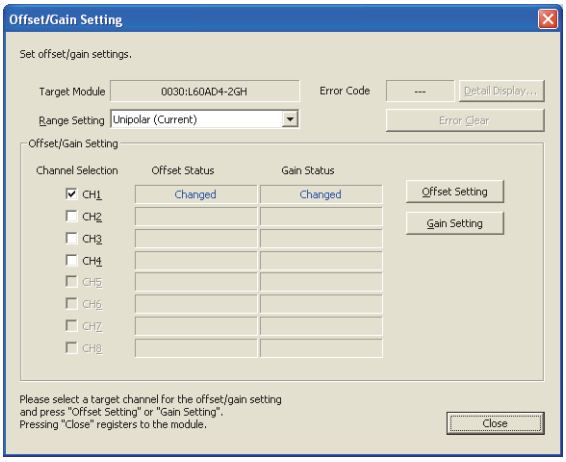


6. **Check that "Offset Status" is changed to "Changed", and click the** Gain Setting **button.**

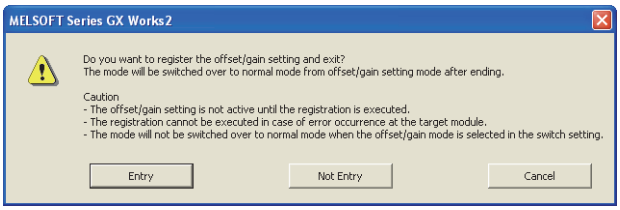
↓


MELSOFT Series GX Works2
Executes the gain settings.
Please press the "Yes" button after setting the voltage/current to the target channel.
Yes
No

↓



↓


MELSOFT Series GX Works2
Do you want to register the offset/gain setting and exit?
The mode will be switched over to normal mode from offset/gain setting mode after ending.
Caution
- The offset/gain setting is not active until the registration is executed.
- The registration cannot be executed in case of error occurrence at the target module.
- The mode will not be switched over to normal mode when the offset/gain mode is selected in the switch setting.
Entry
Not Entry
Cancel

↓

End

7. **Input the gain value voltage or current in the target channel terminal, and click the** Yes **button.**

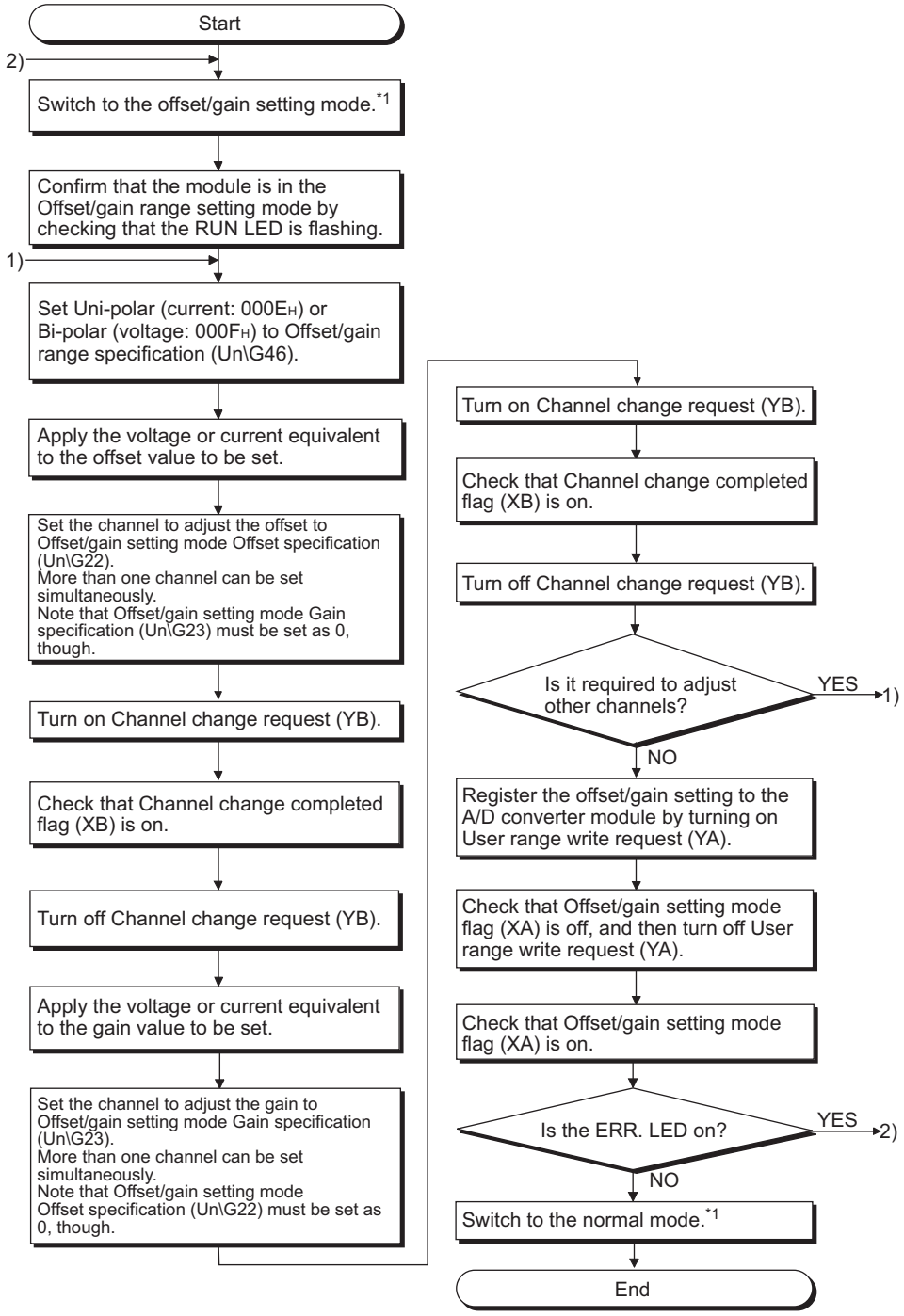
8. **Check that "Gain Status" is changed to "Changed", and click the** Close **button.**

9. **Click the** Entry **button.**

7.5.2 Setting from a program

(1) Setting procedure

The following describes the procedures when setting the offset/gain from a program.


Start
2)
Switch to the offset/gain setting mode.*1
Confirm that the module is in the Offset/gain range setting mode by checking that the RUN LED is flashing.
1)
Set Uni-polar (current: 000EH) or Bi-polar (voltage: 000FH) to Offset/gain range specification (Un\G46).
Apply the voltage or current equivalent to the offset value to be set.
Set the channel to adjust the offset to Offset/gain setting mode Offset specification (Un\G22).
More than one channel can be set simultaneously.
Note that Offset/gain setting mode Gain specification (Un\G23) must be set as 0, though.
Turn on Channel change request (YB).
Check that Channel change completed flag (XB) is on.
Turn off Channel change request (YB).
Apply the voltage or current equivalent to the gain value to be set.
Set the channel to adjust the gain to Offset/gain setting mode Gain specification (Un\G23).
More than one channel can be set simultaneously.
Note that Offset/gain setting mode Offset specification (Un\G22) must be set as 0, though.
Turn on Channel change request (YB).
Check that Channel change completed flag (XB) is on.
Turn off Channel change request (YB).
Is it required to adjust other channels?
YES
1)
NO
Register the offset/gain setting to the A/D converter module by turning on User range write request (YA).
Check that Offset/gain setting mode flag (XA) is off, and then turn off User range write request (YA).
Check that Offset/gain setting mode flag (XA) is on.
Is the ERR. LED on?
YES
2)
NO
Switch to the normal mode.*1
End

*1 The following shows the procedure for switching the mode (normal mode → offset/gain setting mode → normal mode).

- Dedicated instruction (G(P).OFFGAN) (Page 286, Appendix 5.2)
- Setting for Mode switching setting (Un\G158, Un\G159) and turning on then off Operating condition setting request (Y9) (Page 255, Appendix 2 (26))
- Intelligent function module switch setting (Page 57, Section 7.2)

Point

- Configure the offset/gain setting in accordance with the actual use situation.
- Offset and gain values are recorded in the flash memory in the A/D converter module by turning on then off User range write request (YA). Once recorded, the values are not deleted even after the module is powered off.
  When the values are written 26 times in succession, an error occurs and error code (162) is stored in Latest error code (Un\G19) to prevent an improper write to the flash memory. Error flag (XF) turns on and the ERR. LED turns on.
- Configure the offset/gain setting in the range satisfying the following condition.
  When the setting value out of the range is configured, the resolution and accuracy of the module may not fall within the range shown in the following performance specifications.
  - I/O Conversion Characteristic of A/D Conversion (☞ Page 279, Appendix 3)
- Offset/gain setting can be configured for multiple channels at the same time, however, the setting must be configured for offset and gain channels separately.
  When offset and gain channels are set at the same time, an error occurs. The error code (500) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on.
- If a value other than Bi-polar (voltage: $000F_H$) or Uni-polar (current: $000E_H$) is set to the range setting when Channel change request (YB) is turned on, an error occurs. The error code (171) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on.
- When User range write request (YA) is turned on, the integrity between the offset values and gain values is checked. When an error occurs even in one channel, offset/gain values are not written to the module.
  Check the value in Latest error code (Un\G19) and perform the following procedures to reconfigure the offset/gain setting from the beginning.
  - Error Code List (☞ Page 221, Section 11.4)
- When the mode is switched from the offset/gain setting mode to the normal mode by the setting of the dedicated instruction (G(P).OFFGAN) or Mode switching setting (Un\G158, Un\G159), Module READY (X0) turns off then on. Note the initial setting process is performed at the switching of the mode if a sequence program executes the initial setting when Module READY (X0) turns on.
- To validate the intelligent function module switch setting after writing the setting to the CPU module, reset the CPU module or power off then on the module.

(2) Program example

(a) Device

Ex. I/O number of the A/D converter module is X/Y30 to X/Y3F (when the L26CPU-BT is used).

The following table lists the devices used in the program example.

Device	Function
M0	Offset/gain range specification (uni-polar: current)
M1	Offset/gain range specification (bi-polar: voltage)
M2	Channel selection
M3	Offset setting
M4	Gain setting
M5	Channel change command
M6	Write command to module of offset/gain setting value
M7	Mode switching
D0	Storage device for the specified channel
D1	Storage device for the setting value of the dedicated instruction (G(P).OFFGAN)
D2	Storage device for the specified user range

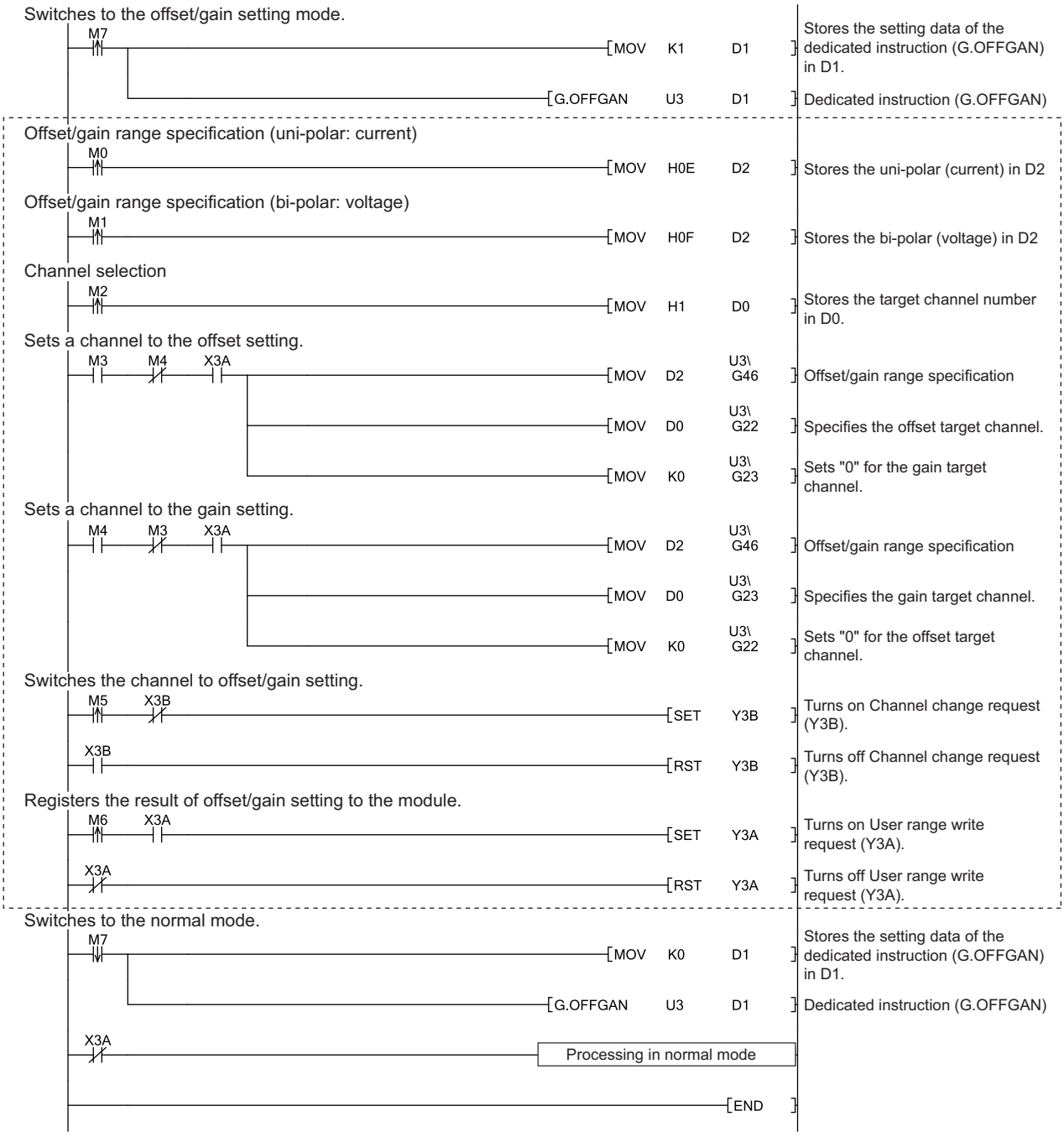
Point

If the L02CPU is used, assign I/O of the A/D converter module to X/Y30 to X/Y3F so that the I/O assignment of the A/D converter module is the same as that in the above system.

(b) Switching the mode by the dedicated instruction (G(P).OFFGAN)

This program performs the following:

- Switching the mode to the offset/gain setting mode by the dedicated instruction (G(P).OFFGAN)
- Switching the channels for which the offset/gain setting is configured
- Writing the offset/gain value to the A/D converter module
- Switching the mode back to the normal mode

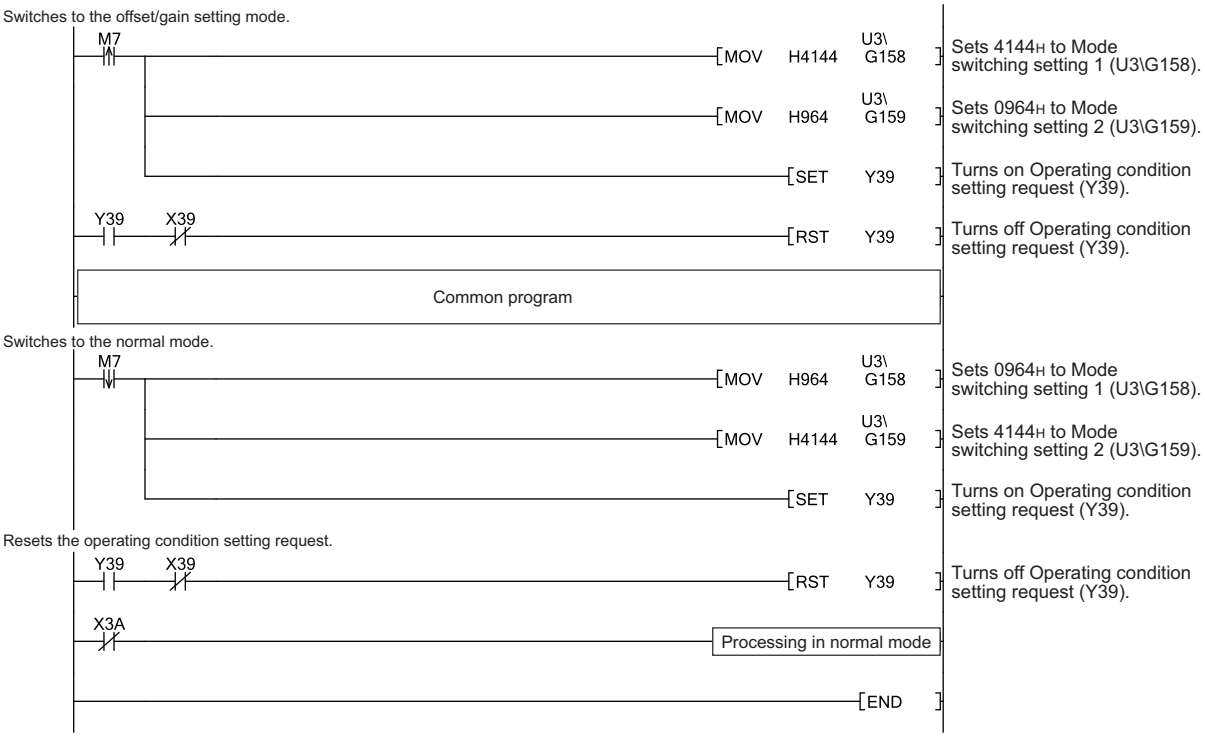


Point

The part enclosed by the dotted line is common to the following three programs.

- Switching the mode by the dedicated instruction (G(P).OFFGAN)
- Switching the mode by setting Mode switching setting (Un\G158, Un\G159) and by Operating condition setting request (Y9)
- Switching the mode by the intelligent function module switch setting

(c) Switching the mode by setting Mode switching setting (Un\G158, Un\G159) and by Operating condition setting request (Y9)


Switches to the offset/gain setting mode.
M7
MOV H4144 U3\G158
Sets 4144H to Mode switching setting 1 (U3\G158).
MOV H964 U3\G159
Sets 0964H to Mode switching setting 2 (U3\G159).
SET Y39
Turns on Operating condition setting request (Y39).
Y39 X39
RST Y39
Turns off Operating condition setting request (Y39).
Common program
Switches to the normal mode.
M7
MOV H964 U3\G158
Sets 0964H to Mode switching setting 1 (U3\G158).
MOV H4144 U3\G159
Sets 4144H to Mode switching setting 2 (U3\G159).
SET Y39
Turns on Operating condition setting request (Y39).
Resets the operating condition setting request.
Y39 X39
RST Y39
Turns off Operating condition setting request (Y39).
X3A
Processing in normal mode
END

(d) Switching the mode by the intelligent function module switch setting

Only the common program is required.

CHAPTER 8 FUNCTIONS

This chapter describes the functions of the A/D converter module and the setting procedures for those functions.
For details on the I/O signals and the buffer memory, refer to the following.

- Details of I/O Signals (☞Page 232, Appendix 1)
- Details of Buffer Memory Addresses (☞Page 240, Appendix 2)

8.1 Modes

The A/D conversion module has the normal mode and the offset/gain setting mode. Change the mode according to the function used.
The following describe each mode.

(1) Normal (A/D Converter Processing) Mode

The normal (A/D Converter Processing) mode normally has External Trigger Convert Request (External Input Terminal) and Internal Trigger Conversion Request (Buffer Memory). In this manual, the description of "normal mode" indicates External Trigger Convert Request (External Input Terminal) and Internal Trigger Conversion Request (Buffer Memory).

(a) Normal

The normal A/D conversion is performed in this mode. The input analog values are converted into digital values.

(b) External Trigger Convert Request (External Input Terminal) and Internal Trigger Conversion Request (Buffer Memory)

The trigger conversion is performed in this mode. The input analog values are converted into digital values according to the input of Trigger conversion request.
For details on the trigger conversion function, refer to the following.

- Trigger Conversion Function (☞Page 162, Section 8.14)

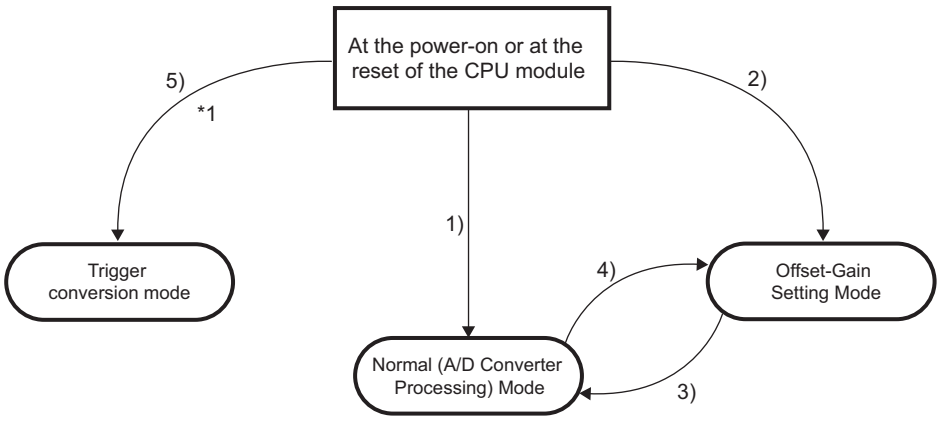
(2) Offset/gain setting mode

The offset/gain setting is performed in this mode.
For details on the offset/gain setting, refer to the following.

- Offset/gain Setting (☞Page 62, Section 7.5)

(3) Mode transitions

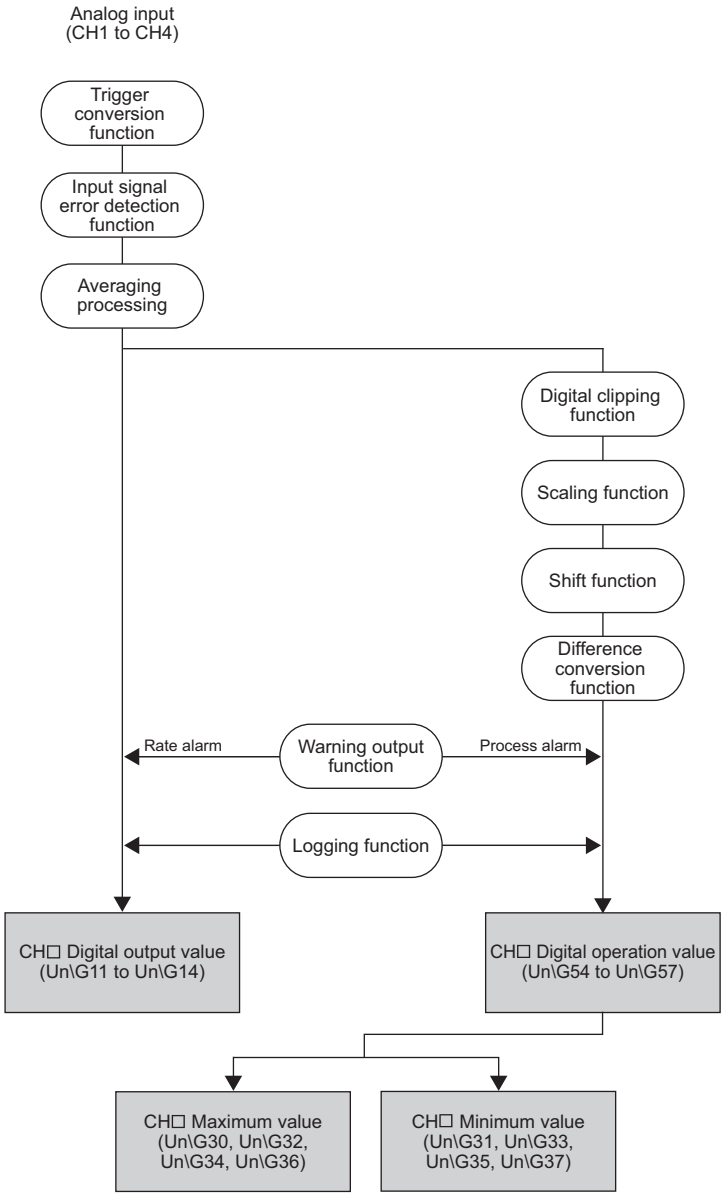
The following figure and table describe the transition condition for each mode.



No.	Transition condition
1)	Set "Drive Mode Setting" to "Normal (A/D Converter Processing) Mode" and "A/D Conversion Timing" to "Normal (Internal Scan)" in "Switch Setting" of GX Works2.
2)	Set "Drive Mode Setting" to "Offset-Gain Setting Mode" and "A/D Conversion Timing" to "Normal (Internal Scan)" in "Switch Setting" of GX Works2.
3)	Perform G(P).OFFGAN (Argument Ⓢ: 0 (normal output mode)).
	Set the following values for Mode switching setting (Un\G158, Un\G159) and turn on then off Operating condition setting request (Y9). • Un\G158: 0964_H • Un\G159: 4144_H
4)	Perform G(P).OFFGAN (Argument Ⓢ: 1 (offset/gain setting mode)).
	Set the following values for Mode switching setting (Un\G158, Un\G159) and turn on then off Operating condition setting request (Y9). • Un\G158: 4144_H • Un\G159: 0964_H
5)	Set "Drive Mode Setting" to "Normal (A/D Converter Processing) Mode" and "A/D Conversion Timing" to "External Trigger Convert Request (External Input Terminal)" or "Internal Trigger Conversion Request (Buffer Memory)" in "Switch Setting" of GX Works2.

8.2 Processing Each Function

The functions are processed in the order shown below. If multiple functions are enabled, the output of the first processed function is used as the input of the next function.



(1) Digital output values

These are digital values after sampling processing or averaging processing has been performed.

(2) Digital operation values

These are values obtained by operating the digital output value using the digital clipping function, scaling function, shift function, or difference conversion function.

(3) Maximum and minimum values

The maximum and minimum values of the digital operation values are stored.

Point

- If averaging processing (time average/count average) is performed, the digital values are stored on the averaging process cycle.
- If the following processing is performed, the digital values are stored on the sampling cycle.
  - Sampling processing
  - Moving average
  - Time lag filter
  - Low pass filter
  - High pass filter
  - Band pass filter

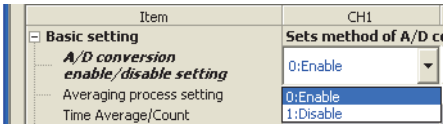
8.3 A/D Conversion Enable/Disable Function

Set whether to enable or disable A/D conversion for each channel.

(1) Setting procedure

Set "A/D conversion enable/disable setting" to "0: Enable".

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



8.4 A/D Conversion Method

One of the following A/D conversion methods can be set for each channel.

- Sampling processing
- Averaging processing (time average, count average, moving average)
- Time lag filter
- Digital filter (low pass filter, high pass filter, band pass filter)

(1) Overview of A/D conversion

A/D conversion is performed per two channels. A/D conversion is performed for CH1 and CH3 simultaneously, then for CH2 and CH4 simultaneously.

(a) Conversion speed

Conversion speed is the time taken for the A/D converter module to convert analog input values into digital values.

(b) Sampling cycle

Sampling cycle is the internal A/D conversion cycle. This cycle varies depending on the setting of the number of A/D conversion-enabled channels (☞Page 73, Section 8.3).

The following table lists the sampling cycles depending on the setting of A/D conversion-enabled channels.

A/D conversion enable/disable setting for CH1 and CH3	A/D conversion enable/disable setting for CH2 and CH4	Sampling cycle
Conversion enabled for CH1 or CH3, or both channels	Conversion disabled for both channels	40μs
Conversion disabled for both channels	Conversion enabled for CH2 or CH4, or both channels	40μs
Conversion enabled for CH1 or CH3, or both channels	Conversion enabled for CH2 or CH4, or both channels	80μs

Point

A/D conversion can be set whether to enable or disable for each channel. Disabling the A/D conversion for unused channels reduces the sampling cycle.

- When A/D conversion is disabled for CH1 to CH3, CH□ Digital output value (Un\G11 to Un\G13) is updated every 80μs.
- When A/D conversion is enabled for CH1 and CH3 only, CH□ Digital output value (Un\G11 to Un\G13) is updated every 40μs.

(c) Conversion cycle

Digital output values are updated on the conversion cycle of sampling cycle, time average, count average, moving average, time lag filter, low pass filter, high pass filter, or band pass filter.
The following table lists the conversion cycles of each A/D conversion method.

A/D conversion method	Conversion cycle
Sampling processing	Sampling cycle
Time average	$\left(\frac{\text{The time set to Time Average/Count Average/Moving Average/Time lag filter constant}}{\text{Sampling cycle}}\right)^{*1} \times \text{Sampling cycle}$
Count average	(The number set to Time Average/Count Average/Moving Average/Time lag filter constant) × Sampling cycle
Moving average	Sampling cycle
Time lag filter	Sampling cycle
Low pass filter	Sampling cycle
High pass filter	Sampling cycle
Band pass filter	Sampling cycle

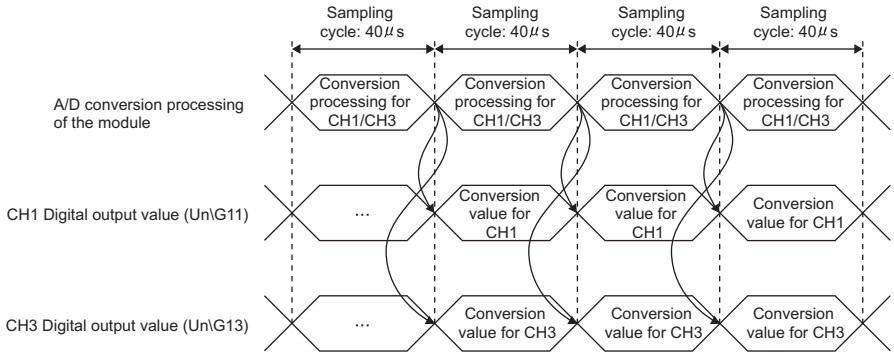
*1 Values after the decimal point are rounded off.

(2) Sampling processing

The A/D converter module executes the A/D conversion of the analog input value sequentially and stores the digital output value to the buffer memory on the sampling cycle.

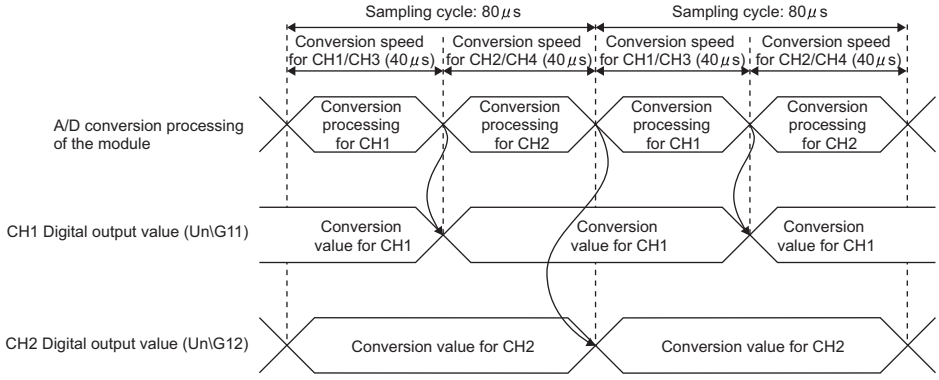
Ex. The sampling cycle is 40μs under the following settings.

- Averaging process setting: Sampling processing
- A/D conversion-enabled channels: CH1, CH3



Ex. The sampling cycle is 80μs under the following settings.

- Averaging process setting: Sampling processing
- A/D conversion-enabled channels: CH1, CH2


Sampling cycle: 80μs
Sampling cycle: 80μs
Conversion speed for CH1/CH3 (40μs)
Conversion speed for CH2/CH4 (40μs)
Conversion speed for CH1/CH3 (40μs)
Conversion speed for CH2/CH4 (40μs)
A/D conversion processing of the module
Conversion processing for CH1
Conversion processing for CH2
Conversion processing for CH1
Conversion processing for CH2
CH1 Digital output value (Un\G11)
Conversion value for CH1
Conversion value for CH1
Conversion value for CH1
CH2 Digital output value (Un\G12)
Conversion value for CH2
Conversion value for CH2

(3) Averaging processing

The A/D converter module performs averaging processing on the digital output values and stores the average values to the buffer memory. The following processing is provided for averaging processing.

- Time average
- Count average
- Moving average

(a) Time average

The A/D converter module executes the A/D conversion for set time, and stores the average of the total value excluding the maximum and the minimum values to the buffer memory.
The processing count in the setting time varies depending on the sampling cycle.

$$\text{Number of processing} = \frac{\text{Set time}}{\text{Sampling cycle}}$$

Ex. The processing count for the following settings is calculated below:

Item	Setting
Number of channels used (the number of channels set to A/D conversion enabled)	4 channels (CH1 to CH4)
Setting time	15ms

15 ÷ 0.08 = 187.5 (times) ... Values after the decimal point are omitted.
→ Conversion is processed 187 times and the averaged value is output.

Point

The valid lower limit setting value for the time average is calculated by "(minimum processing count of 4) × (sampling cycle)".
When 4 (maximum) channels are used: 80μs × 4 = 320μs

(b) Count average

The A/D converter module executes the A/D conversion for set time, and stores the average of the total value excluding the maximum and the minimum values to the buffer memory.
The time taken for storing the count average value to the buffer memory varies depending on the sampling cycle.

Processing time = Set number of times × Sampling cycle

Ex. The processing count for the following settings is calculated below:

Item	Setting
Number of channels used (the number of channels set to A/D conversion enabled)	4 channels (CH1 to CH4)
Set number of times	20 times

20 × 0.08 = 1.6 (ms) → An average value is output every 1.6 ms.

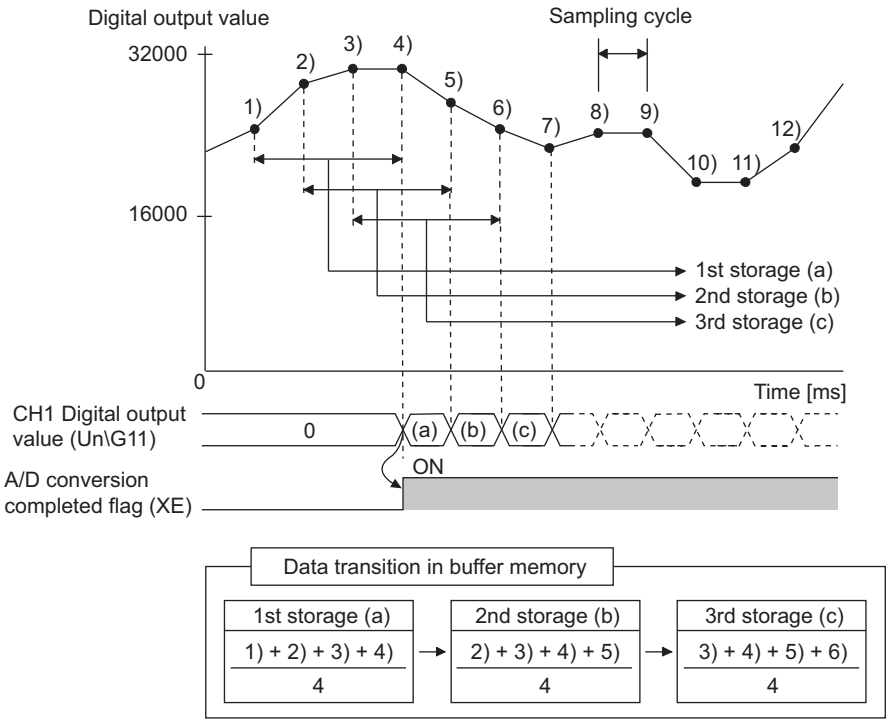
Point

Because the count average requires a sum of at least two counts, not counting the maximum and minimum values, the set number of times should be four or more.

(c) Moving average

The A/D converter module averages digital output values of set number of times which are measured every sampling cycle, and stores them in the buffer memory. Since the averaging processing is performed on a moving set of sampling processing, the latest digital output values can be obtained.

The following figure shows the moving average processing of when the set number of times is four.



(4) Time lag filter

The A/D converter module outputs digital output values with smoothed noise.
To use the time lag filter, set the time lag filter for averaging processing and the time lag filter constant.

Time constant = Sampling cycle × Time lag filter constant

The A/D converter module performs time lag filter processing using the time constant calculated by multiplying the set time lag filter constant by the sampling cycle.
The following are the relational expressions of time constants and digital output values. Set CH□ Time Average/Count Average/Moving Average/Time lag filter constant (Un\G1 to Un\G4) according to application.

[n = 1*1]

$Yn = 0$

[n = 2]

$$Yn = yn\text{-}1 + \frac{\Delta t}{\Delta t + TA}(yn - yn\text{-}1)$$

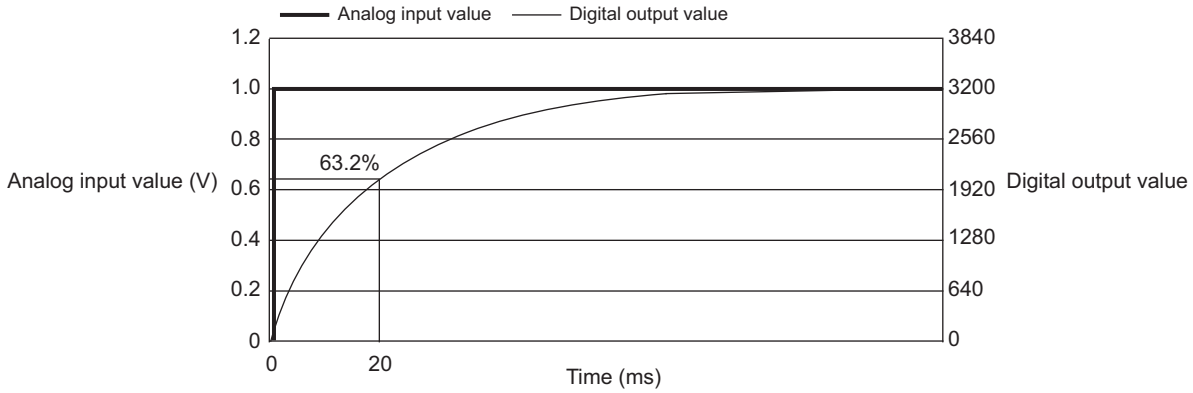
[n ≥ 3]

$$Yn = Yn\text{-}1 + \frac{\Delta t}{\Delta t + TA}(yn - Yn\text{-}1)$$

Yn	: Present digital output value	yn	: Digital output value before smoothing
Yn-1	: Last digital output value	yn-1	: Last digital output value before smoothing
n	: Number of sampling	Δt	: Conversion time (Sampling cycle)
TA	: Time constant		

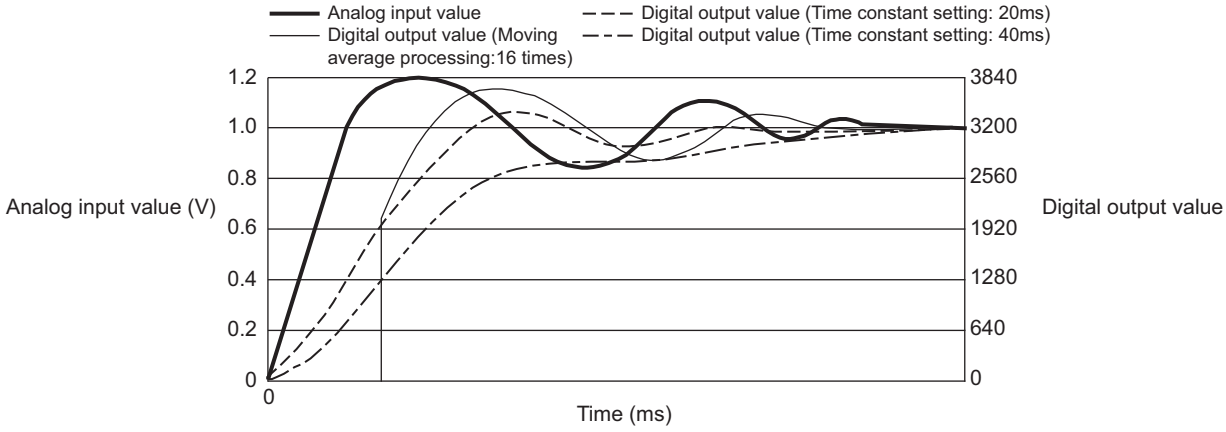
*1 A/D conversion completed flag (XE) turns on when n ≥ 2.

[Digital output value when the analog input value is changed from 0 to 1V]
The following figure shows the change of the digital output value with the input range of 0 to 10V and the time constant (Sampling cycle × Time lag filter constant) of 20ms.
After 20ms from the analog input value becomes 1V, the digital output value reaches 63.2% of the digital output value of when the sampling processing is selected.



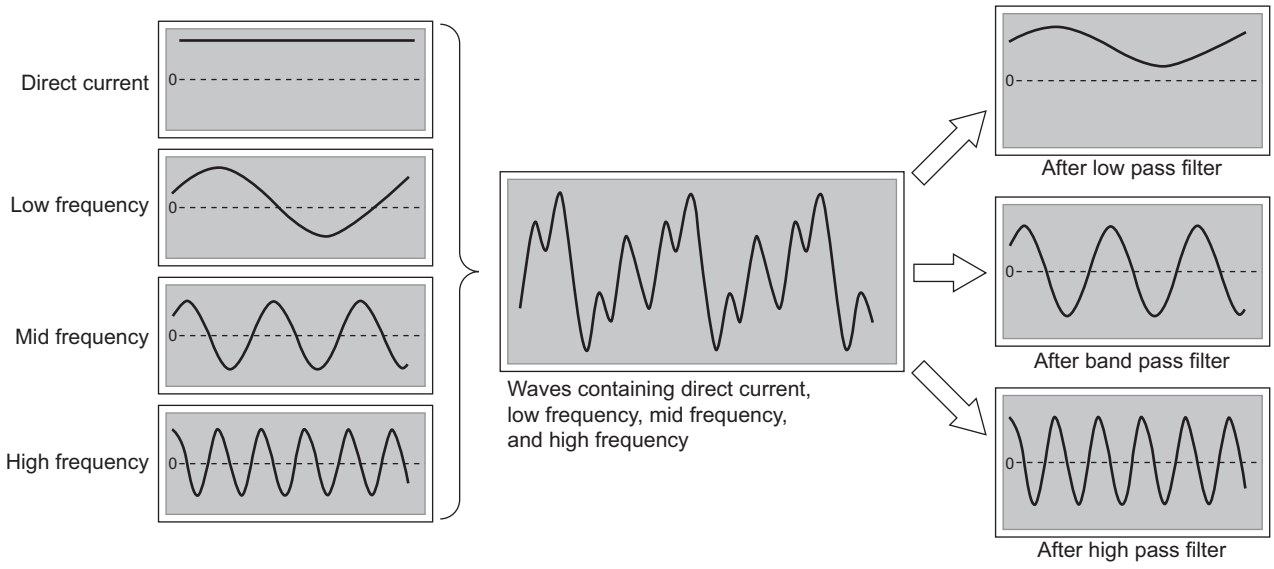
[Digital output value of when the analog input value change forms a waveform containing ringing]
The following figure shows the change ratio of the digital output value with the input range of 0 to 10V and the moving average processing of 16 times under the following conditions.

- Sampling cycle × Time lag filter constant (Time constant): 40ms
- Sampling cycle × Time lag filter constant (Time constant): 20ms
- Moving average processing: 16 times



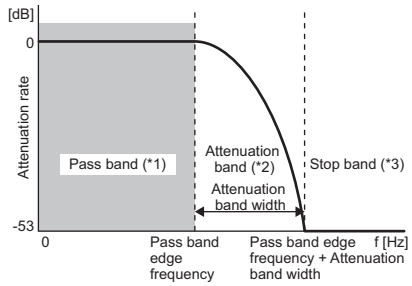
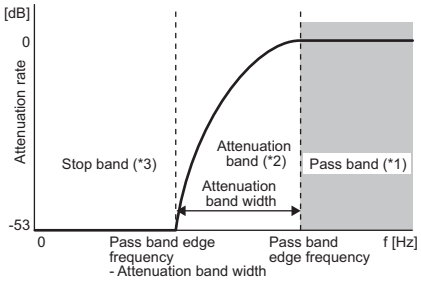
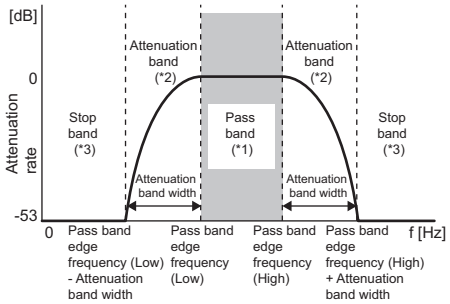
(5) Digital filter

When data is obtained from a sensor connected with the A/D converter module, the converted values may be output with unnecessary noise from the sensor. This function removes noise by attenuating unnecessary frequency data. Thus, only digital values with target frequency data can be obtained.
Select the low pass filter, the high pass filter, or the band pass filter according to a sensor connected. When the high pass filter or the band pass filter is used, direct signals are eliminated.



(a) Characteristics and advantages of the digital filters

The following table lists the characteristics and advantages of the digital filters.

Filter type	Characteristic	Advantage
Low pass filter (low frequency pass filter)		• Performed every sampling cycle (conversion cycle). • This filter attenuates frequency signals between a pass band edge frequency and the pass band edge frequency + an attenuation band width, cutting off frequency signals higher than the attenuation band. • The target frequency of the filtering should be the same as, or lower than 1/2 of Sampling frequency*4.
High pass filter (high frequency pass filter)		• Performed every sampling cycle (conversion cycle). • This filter attenuates frequency signals between a pass band edge frequency and the pass band edge frequency - an attenuation band width, cutting off frequency signals lower than the attenuation band. • The target frequency of the filtering should be the same as, or lower than 1/2 of Sampling frequency*4.
Band pass filter (band frequency pass filter)		• Performed every sampling cycle (conversion cycle). • Both a low pass filter (low frequency pass filter) and a high pass filter (high frequency pass filter) are set simultaneously. As a result, only frequency within a specified bandwidth passes this filter. • The target frequency of the filtering should be the same as, or lower than 1/2 of Sampling frequency*4.

*1 Pass band: Frequency bandwidth which passes through the filter without being attenuated

*2 Attenuation band: Frequency bandwidth whose attenuation rate through the filter is in a transition state

*3 Stop band: Frequency bandwidth attenuated by the filter

*4 Sampling frequency: The reciprocal of the sampling cycle (1/Sampling cycle)

(b) How to use the digital filters

To use the digital filtering function, set a digital filter (Low pass filter (5), High pass filter (6), or Band pass filter (7)) to Averaging process setting (Un\G24), set a pass band edge frequency and an attenuation band width, and turn on then off Operating condition setting request (Y9).

The following table lists the setting ranges for each digital filter.

<table>
<tr><th>Digital filter</th><th>Buffer memory</th><th>Description of setting and setting range</th></tr>
<tr><td rowspan="3">Low pass filter</td><td>Averaging process setting (Un\G24)</td><td>Set a relevant bit of a channel where filter processing is necessary to Low pass filter (5).</td></tr>
<tr><td>CH☐ LPF Pass band edge frequency (Un\G300 to Un\G303)</td><td>Set a pass band edge frequency for the low pass filter.
The following table shows the setting range of the frequency.
When a frequency out of the setting range is set, an error occurs. Error code (230☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on.
<table><tr><th>Sampling cycle</th><th>Setting range</th></tr><tr><td>40μs</td><td>• Pass band edge frequency + Attenuation band width ≤ 12000
• 330 ≤ attenuation band width
• 0 ≤ pass band edge frequency</td></tr><tr><td>80μs</td><td>• Pass band edge frequency + Attenuation band width ≤ 6000
• 170 ≤ attenuation band width
• 0 ≤ pass band edge frequency</td></tr></table></td></tr>
<tr><td>CH☐ Attenuation band width (Un\G332 to Un\G335)</td><td>Set an attenuation band width for each channel.
Set an attenuation band. The sum of an LPF pass band edge frequency and the attenuation band width becomes the boundary between the attenuation band and a stop band.
The frequency higher than the sum of the LPF pass band edge frequency and attenuation band width is attenuated.</td></tr>
<tr><td rowspan="3">High pass filter</td><td>Averaging process setting (Un\G24)</td><td>Set a relevant bit of a channel where filter processing is necessary to High pass filter (6).</td></tr>
<tr><td>CH☐ HPF Pass band edge frequency (Un\G308 to Un\G311)</td><td>Set a pass band edge frequency for the high pass filter.
The following table shows the setting range of the frequency.
When a frequency out of the setting range is set, an error occurs. Error code (231☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on.
<table><tr><th>Sampling cycle</th><th>Setting range</th></tr><tr><td>40μs</td><td>• 0<Pass band edge frequency - Attenuation band width
• 330 ≤ Attenuation band width
• Pass band edge frequency ≤ 12000</td></tr><tr><td>80μs</td><td>• 0<Pass band edge frequency - Attenuation band width
• 170 ≤ attenuation band width
• Pass band edge frequency ≤ 6000</td></tr></table></td></tr>
<tr><td>CH☐ Attenuation band width (Un\G332 to Un\G335)</td><td>Set an attenuation band width for each channel.
Set an attenuation band width. The difference between an HPF pass band edge frequency and the attenuation band width becomes the boundary between the attenuation band and a stop band.
The frequency lower than the difference between the HPF pass band edge frequency and attenuation band width is attenuated.</td></tr>
</table>

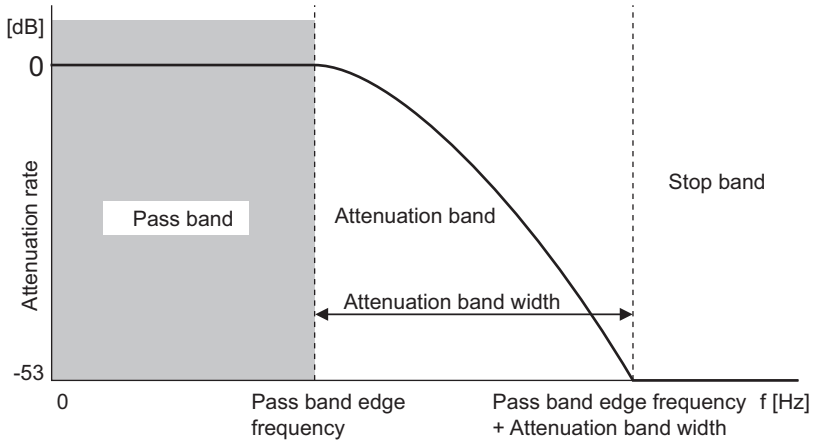
<table>
<tr><th>Digital filter</th><th>Buffer memory</th><th>Description of setting and setting range</th></tr>
<tr><td rowspan="3">Band pass filter</td><td>Averaging process setting (Un\G24)</td><td>Set a relevant bit of a channel where filter processing is necessary to Band pass filter (7).</td></tr>
<tr><td>• CH□ BPF Pass band edge frequency (Low) (Un\G316, Un\G318, Un\G320, Un\G322)
• CH□ BPF Pass band edge frequency (High) (Un\G317, Un\G319, Un\G321, Un\G323)</td><td>Set a pass band edge frequency for the band pass filter.
The following table shows the setting range of the frequency.
When frequency out of the setting range is set, an error occurs. Error code (232□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on.
<table>
<tr><th>Sampling cycle</th><th>Setting range</th></tr>
<tr><td>40μs</td><td>• Pass band edge frequency (High) + Attenuation band width ≤ 12000
• 0<Pass band edge frequency (Low) - Attenuation band width
• 330 ≤ attenuation band width
• Pass band edge frequency (Low) < Pass band edge frequency (High)</td></tr>
<tr><td>80μs</td><td>• Pass band edge frequency (High) + Attenuation band edge ≤ 6000
• 0<Pass band edge frequency (Low) - Attenuation band width
• 170 ≤ attenuation band width
• Pass band edge frequency (Low) < Pass band edge frequency (High)</td></tr>
</table></td></tr>
<tr><td>CH□ Attenuation band width (Un\G332 to Un\G335)</td><td>This setting is common to both lower and higher sides.
Set an attenuation band width for each channel.
• The difference between a BPF pass band edge frequency (Low) and the attenuation band width is the boundary between the lower attenuation band and a stop band.
The frequency lower than the difference between the BPF pass band edge frequency (Low) and attenuation band width is attenuated.
• The sum of the BPF pass band edge frequency (High) and attenuation band width is the boundary between the higher attenuation band and stop band.
The frequency higher than the sum of the BPF pass band edge frequency (High) and attenuation band width is attenuated.</td></tr>
</table>

(c) Attenuation characteristic and response time

The AD converter module uses FIR filters as the digital filters.
A FIR filter has linear phase response, provides system stability, and displays a steep attenuation characteristic, but takes time to respond.

[Attenuation characteristic]
The digital filters of the A/D converter module set the boundary frequency between a pass band and an attenuation band. Also the filters set the boundary frequency between the attenuation band and a stop band (pass band edge frequency + attenuation band width).
An attenuation characteristic is composed of the attenuation band and the attenuation rate (-53(dB)) shown with the pass band edge frequency and the pass band edge frequency + the attenuation band width.

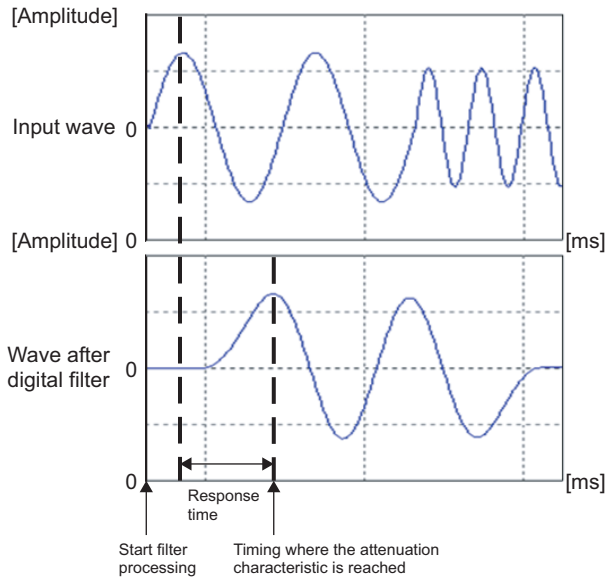
Ex. The following figure shows the attenuation characteristic (the attenuation band and attenuation rate) when the low pass filter is used.



[Response time]

Response time is the time taken to obtain an attenuation rate (-53(dB)) after filter processing is started. The following figure shows response time.

Ex. The output waveform obtained after an input SIN wave passed through a digital filter.



Response time is obtained from the following calculation.

Response time = Sampling cycle × Filter degree*1

*1 A filter degree is a value that the system internally derives from a pass band edge frequency and a conversion frequency of the A/D converter module (reciprocal of the sampling cycle). The range of a filter degree is 1 to 255.

Point

Decimals of the filter degree are raised to the next whole number to preserve its attenuation characteristic. If the value becomes an even number, 1 is added to the value so that the value becomes an odd number and that phase shifting is prevented.

- Filter degree = ((Filter degree + 1) / 2)*1 × 2 + 1

*1 Decimals are raised to the next whole number.

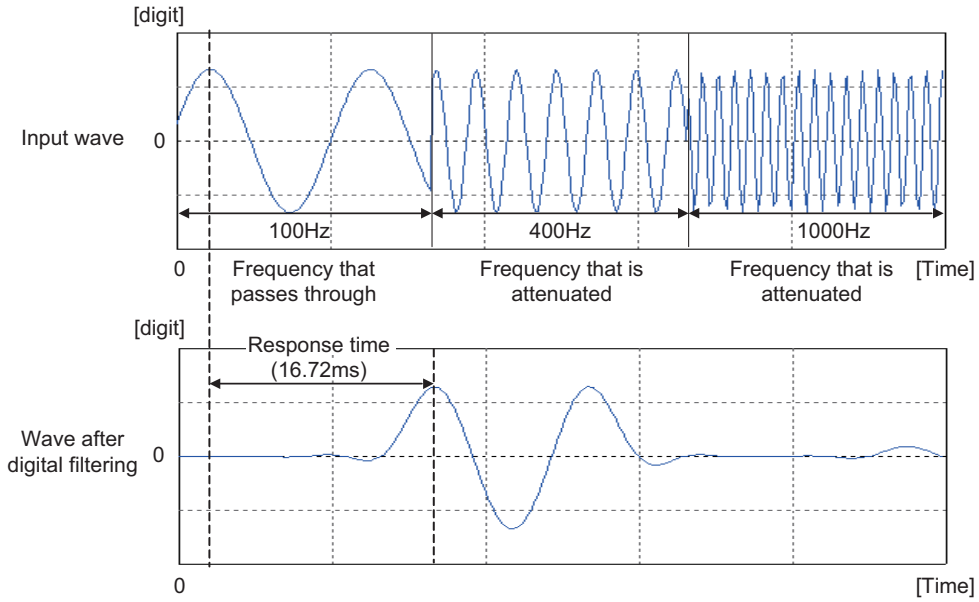
(d) Setting example of when a digital filter is set

The following shows the setting example of when a digital filter is set.

Ex. 1: When the low pass filter is used under the following conditions

- To input a SIN wave, the frequency of analog inputs is changed from 100Hz to 400Hz, and 400Hz to 1000Hz.
- Sampling cycle: 80μs (Sampling frequency: 12.5kHz)
- Averaging process setting: Low pass filter
- Pass band edge frequency: 140Hz
- Attenuation band width: 200Hz

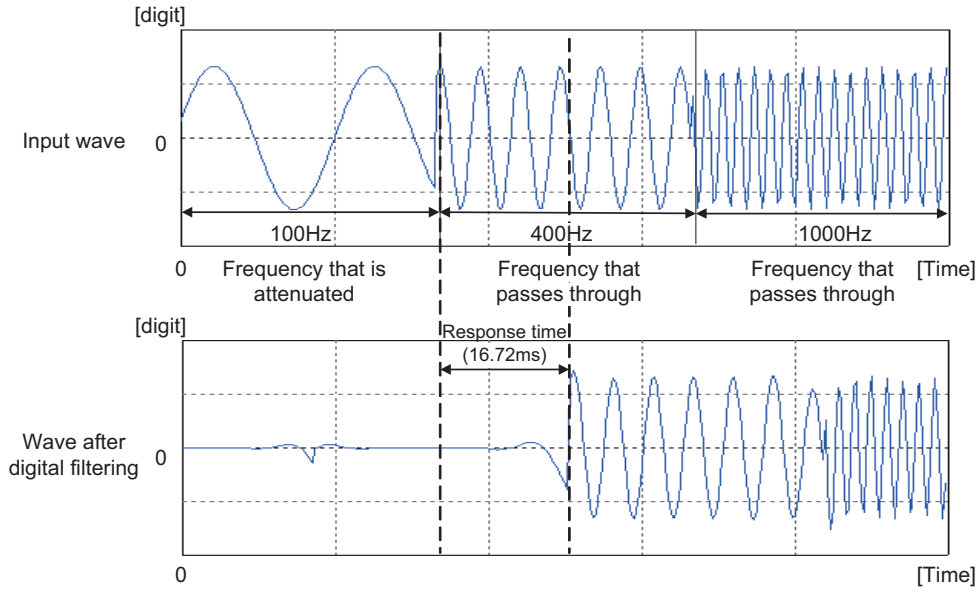
The response time is 16.72ms (= Sampling cycle (80μs) × Filter degree (209)).



Ex. 2: When the high pass filter is used under the following conditions

- To input a SIN wave, the frequency of analog inputs is changed from 100Hz to 400Hz, and 400Hz to 1000Hz.
- Sampling cycle: 80µs (Sampling frequency: 12.5Hz)
- Averaging process setting: High pass filter
- Pass band edge frequency: 340Hz
- Attenuation band width: 200Hz

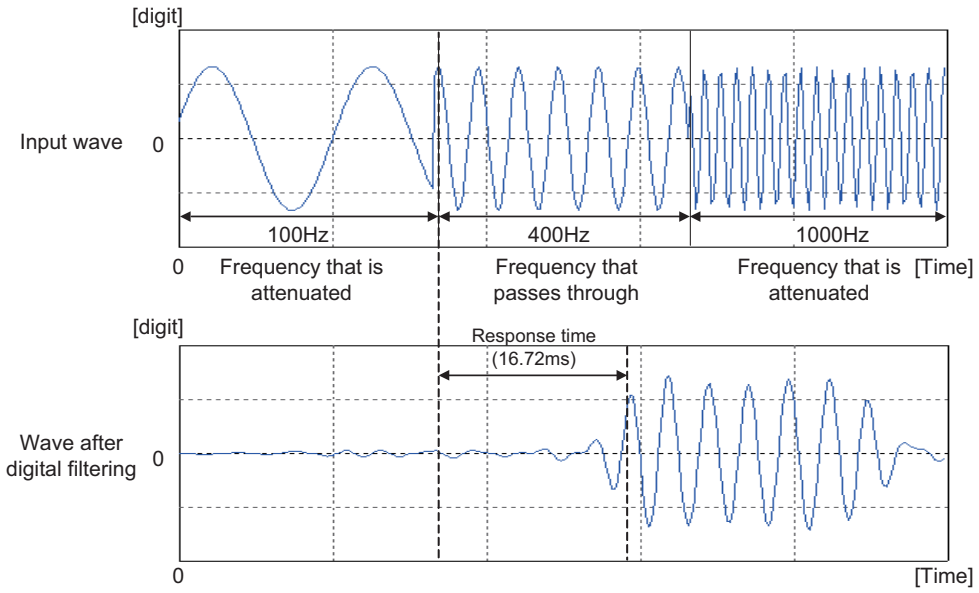
The response time is 16.72ms (= Sampling cycle (80µs) × Filter degree (209)).



Ex. 3: When the band pass filter is used under the following conditions

- To input a SIN wave, the frequency of analog inputs is changed from 100Hz to 400Hz, and 400Hz to 1000Hz.
- Sampling cycle: 80μs (Sampling frequency: 12.5Hz)
- Averaging process setting: Band pass filter
- Pass band edge frequency (Low): 320Hz
- Pass band edge frequency (High): 580Hz
- Attenuation band width: 200Hz

The response time is 16.72ms (= Sampling cycle (80μs) × Filter degree (209)).

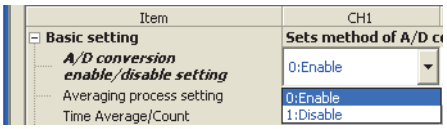


(6) Setting procedure

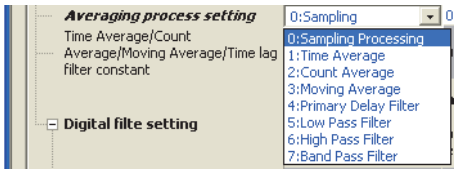
(a) Sampling processing

1. Set "A/D conversion enable/disable setting" to "0: Enable".

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



2. Set "Averaging process setting" to "0: Sampling Processing".

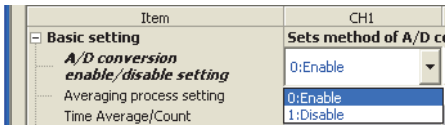


(b) Averaging processing and Time lag filter

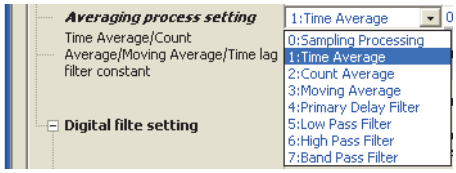
Ex. When "Averaging process setting" is set to "1: Time Average"

1. **Set "A/D conversion enable/disable setting" to "0: Enable".**

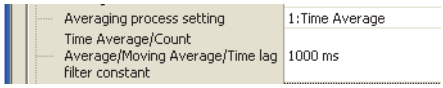
Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



2. **Set "Averaging process setting" to "1: Time Average".**



3. **Set "Time Average/Count Average/Moving Average/Time lag filter constant" to an averaging processing value.**

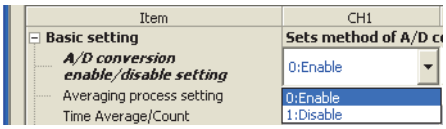


Setting item	Setting range
Time average	2 to 5000ms
Count average	4 to 65000 times
Moving average	2 to 1000 times
Time lag filter	1 to 500 times

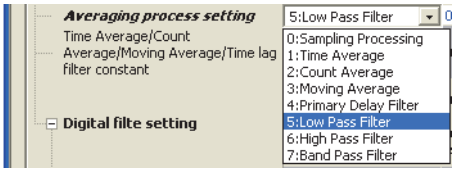
(c) Low pass filter

1. **Set "A/D conversion enable/disable setting" to "0: Enable".**

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



2. **Set "Averaging process setting" to "5: Low Pass Filter".**



3. **Set "LPF Pass band edge frequency" to a pass band edge frequency.**



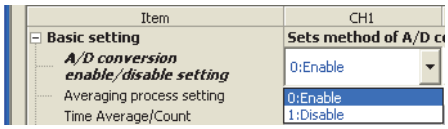
4. **Set "Attenuation band width" to an attenuation band width. The difference between the HPF pass band edge frequency and attenuation band width is the boundary between the attenuation band and a stop band. The frequency lower than the difference between the HPF pass band edge frequency and attenuation band width is attenuated.**



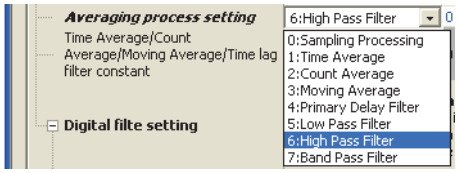
(d) High pass filter

1. Set "A/D conversion enable/disable setting" to "0: Enable".

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



2. Set "Averaging process setting" to "6: High Pass Filter".



3. Set "HPF Pass band edge frequency" to a pass band edge frequency.



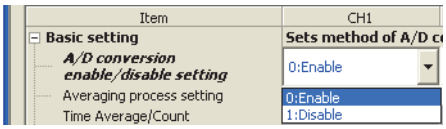
4. Set "Attenuation band width" to an attenuate band width. The difference between the HPF pass band edge frequency and attenuation band width is the boundary between the attenuation band and a stop band. The frequency lower than the difference between the HPF pass band edge frequency and attenuation band width is attenuated.



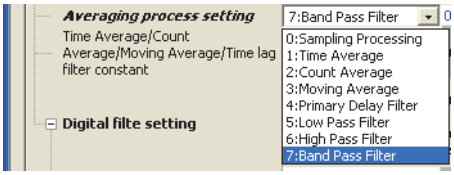
(e) Band pass filter

1. Set "A/D conversion enable/disable setting" to "0: Enable".

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



2. Set "Averaging process setting" to "7: Band Pass Filter".



3. Set "BPF Pass band edge frequency (Low)" and "BPF Pass band edge frequency (High)" to pass band edge frequencies.



4. Set an attenuation band width.

The difference between the BPF pass band edge frequency (Low) and attenuation band width is the boundary between the lower attenuation band and a stop band.
The frequency lower than the difference between the BPF pass band edge frequency (Low) and attenuation band width is attenuated.
The sum of the BPF pass band edge frequency (High) and attenuation band width is the boundary between the higher attenuation band and a stop band.
The frequency higher than the sum of the BPF pass band edge frequency (High) and attenuation band width is attenuated.



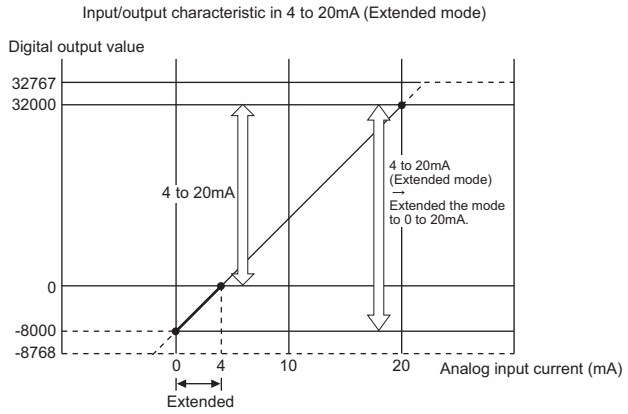
8.5 Input Range Extended Mode Function

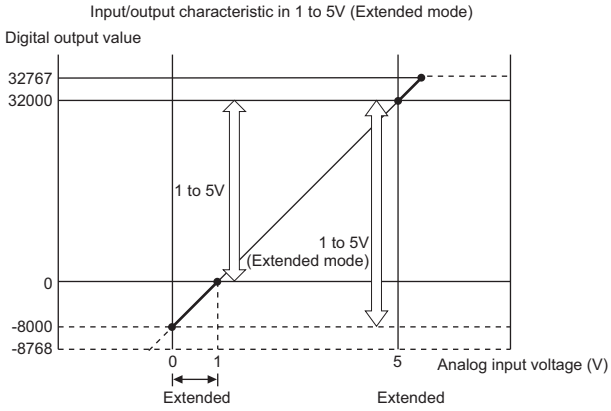
This function extends the input range of 4 to 20mA and that of 1 to 5V.

Normal mode				Extended mode		
Input range setting	Input range	Digital output value		Input range setting	Input range	Digital output value
4 to 20mA	4 to 20mA	0 to 32000	⇔	4 to 20mA (Extended mode)	0.0 to 20.0mA	-8000 to 32000
1 to 5V	1 to 5V			1 to 5V (Extended mode)	0.0 to 5.0V	

(1) Overview

- An analog input value can be monitored even when an error in measurement is great and the value is less than 4mA or 1V in the input range of 4 to 20mA and 1 to 5V.
- Although the slope of the I/O characteristic in the extended mode is the same as that in the normal mode, the upper limit value and the lower limit value of the input range and the digital output value are extended.
- The resolution is the same as that the input range of 4 to 20mA and 1 to 5V has. Therefore, A/D conversion with higher resolution than that of the input range of 0 to 20mA and 0 to 5V is achieved.





For details on the current input characteristic and the voltage input characteristic, refer to the following.

- I/O Conversion Characteristic of A/D Conversion (☞Page 279, Appendix 3)

(2) Setting procedure

Set with the input range setting of the switch setting.

Point

When the input range extended mode function is used with the scaling function, the shift function, and the difference conversion function, digital output values may exceed the range of -32768 to 32767.

In that case, the value fixed at the upper limit value (32767) or the lower limit value (-32768) is stored as a digital operation value.

- Processing Each Function (☞Page 71, Section 8.2)

8.6 Maximum Value/Minimum Value Hold Function

The A/D converter module stores the maximum and minimum values of the digital operation values for each channel in the buffer memory.
Values are refreshed every conversion cycle.
For the conversion cycle, refer to the following.

- Conversion cycle (☞Page 75, Section 8.4 (1) (c))

For the buffer memory address where the values are stored, refer to the following.

- List of Buffer Memory Addresses (☞Page 32, Section 3.5)

(1) Resetting the maximum value and the minimum value

- The maximum value and the minimum value are refreshed with present values by turning on then off Maximum value/minimum value reset request (YD).
- The maximum value and the minimum value are refreshed with digital operation values by turning on then off Operating condition setting request (Y9).

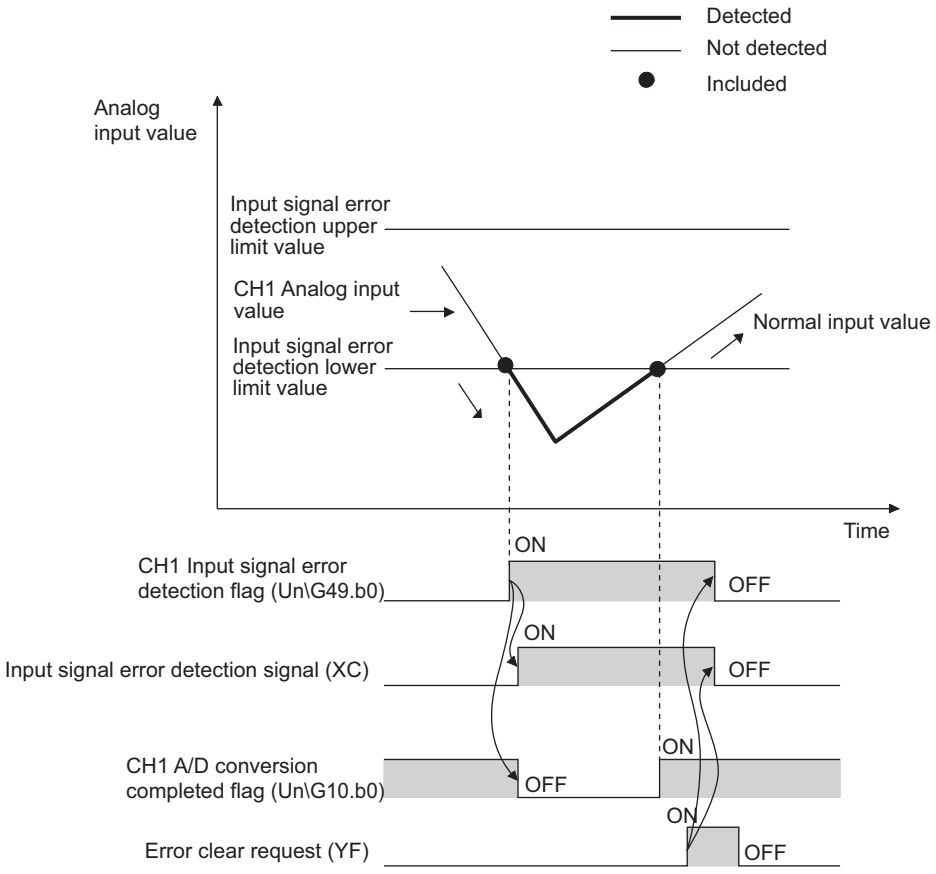
(2) Target value for maximum value and minimum value

The maximum and minimum values of digital operation values are stored in the buffer memory.
For details, refer to the following.

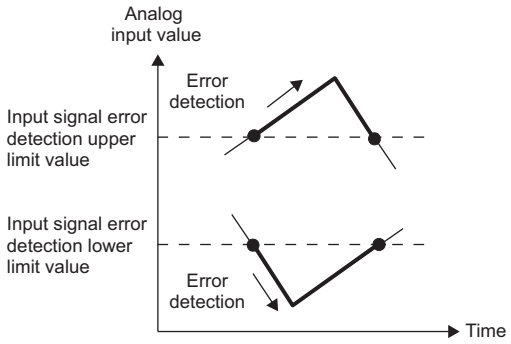
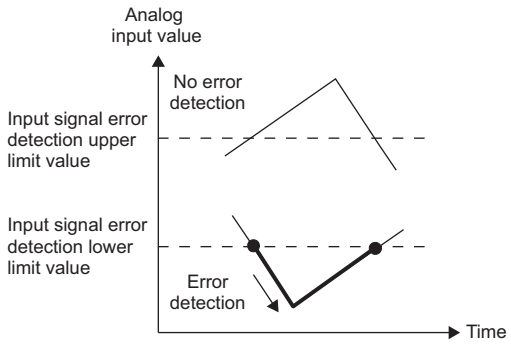
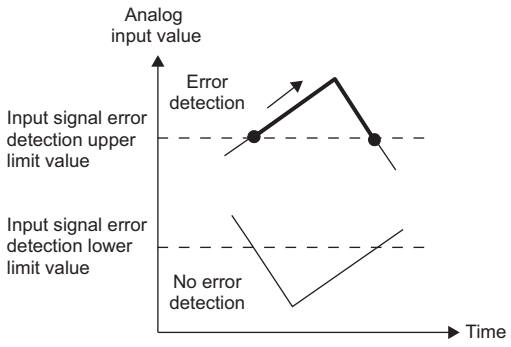
- Processing Each Function (☞Page 71, Section 8.2)

8.7 Input Signal Error Detection Function

This function detects an analog input value which exceeds a setting range.



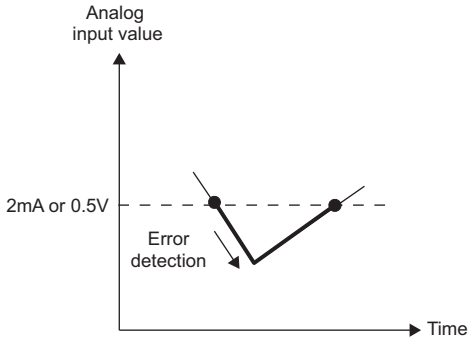
(1) Detection condition

Detection method	Detection condition	
Upper lower limit detection	At the input signal error detection upper limit value or above, and at the input signal error detection lower limit value or below	
Lower limit detection	At the input signal error detection lower limit value or below	
Upper limit detection	At the input signal error detection upper limit value or above	
Disconnection detection	Performs disconnection detection. For details, refer to the following. • Disconnection detection (☞ Page 98, Section 8.7 (1) (a))	

(a) Disconnection detection

This function provides simple disconnection detection in combination with the input range extended mode function. When either of following conditions is satisfied, Input signal error detection flag (Un\G49) turns on and a disconnection occurs.

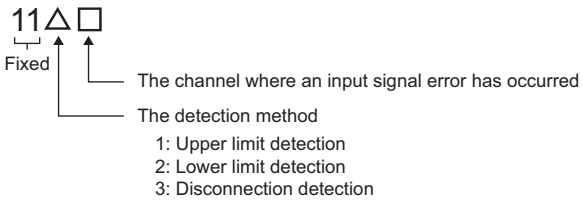
Input range	Disconnection detection condition
4 to 20mA (Extended mode)	Input analog value ≤ 2mA
1 to 5V (Extended mode)	Input analog value ≤ 0.5V



The setting for CH☐ Input signal error detection setting value (Un\G142 to Un\G145) is ignored.

(2) Notifying input signal error

When an analog input value satisfies a preset detection condition of the detection method, the error is notified with Input signal error detection flag (Un\G49), Input signal error detection signal (XC) and flashing of ALM LED. In addition, alarm code (11 △☐) is stored in Latest error code (Un\G19). The value of the alarm code varies depending on the condition (upper limit, lower limit, or disconnection detection) under which an error of the analog input value is detected.



For details on the alarm codes, refer to the following.

- Alarm Code List (☞Page 226, Section 11.5)

(3) Operation of the input signal error detection function

An error-detected channel holds the digital value just before the error was detected, and A/D conversion completed flag (Un\G10) and A/D conversion completed flag (XE) turn off.

When the analog input value returns within the setting range, A/D conversion resumes regardless of the reset on Input signal error detection flag (Un\G49) and Input signal error detection signal (XC). A/D conversion completed flag (Un\G10) of this channel turns on again after the first refresh. (ALM LED remains flashing.)

(4) Detection cycle

This function works on the sampling cycle.

(5) Clearing input signal errors

After the analog input value returns within the setting range, turn on then off Error clear request (YF).
The A/D converter module arranges the following status when an input signal error is cleared.

- Clears Input signal error detection flag (Un\G49).
- Turns off Input signal error detection signal (XC).
- Turns off the ALM LED.
- Clears alarm code (11 △□) stored in Latest error code (Un\G19).

(6) Setting method of the input signal error detection upper limit value and the input signal error detection lower limit value

Set the input signal error detection upper limit value and input signal error detection lower limit value to a value based on the input signal error detection setting value. (Set in a unit of 1 (0.1%).)
Both the input signal error detection upper limit value and the input signal error detection lower limit value reflect the input signal error detection setting value.

(a) Input signal error detection upper limit value

This value is calculated by adding "Input range width (gain value - offset value) × Input signal error detection setting value" to a gain value. The input signal error detection setting value is calculated by the following formula.

$$\text{Input signal error detection setting value} = \frac{\text{Input signal error detection upper limit value} - \text{Gain value of each range}}{\text{Gain value of each range} - \text{Offset value of each range}} \times 1000$$

(b) Input signal error detection lower limit value

This value is calculated by subtracting "Input range width (gain value - offset value) × Input signal error detection setting value" from the lower limit value of the input range (offset value). The input signal error detection setting value is calculated by the following formula.

$$\text{Input signal error detection setting value} = \frac{\text{Lower limit value of each range} - \text{Input signal error detection lower limit value}}{\text{Gain value of each range} - \text{Offset value of each range}} \times 1000$$

Remark

The following table lists the lower limit value, offset value, and gain value for each range.

Analog input range		Lower limit value	Offset value	Gain value
Voltage	0 to 10V	0V		10V
	0 to 5V	0V		5V
	1 to 5V	1V		5V
	-10 to 10V	-10V	0V	10V
	1 to 5V (Extended mode)	1V		5V
	User range setting (Bi-polar: voltage)	The analog input value of when the digital output value is -32000	The analog input value set as an offset value by users	The analog input value set as a gain value by users
Current	0 to 20mA	0mA		20mA
	4 to 20mA	4mA		20mA
	4 to 20mA (Extended mode)	4mA		20mA
	User range setting (Uni-polar: current)	The analog input value set as an offset value by users	The analog input value set as an offset value by users	The analog input value set as a gain value by users

(7) Setting example of input signal error detection

Ex. To detect an error when the analog input value becomes lower than 2.4mA at a channel with the input range of 4mA to 20mA:

Assign the following values to the calculation formula of the input signal error detection lower limit value.

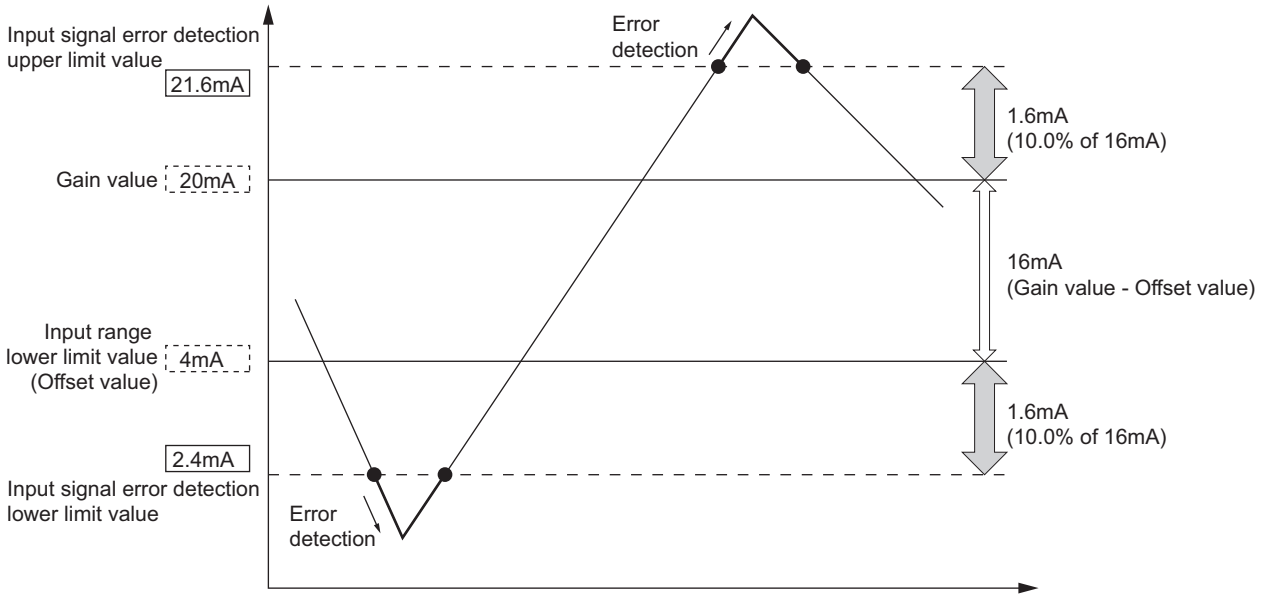
- Input signal error detection lower limit value: 2.4mA
- The lower limit value of the input range (offset value): 4.0mA
- Gain value: 20.0mA

$$\text{Input signal error detection setting value} = \frac{4.0 - 2.4}{20.0 - 4.0} \times 1000$$

$$= 100(10.0\%)$$

Thus, set the input signal error detection setting value to "100(10.0%)".

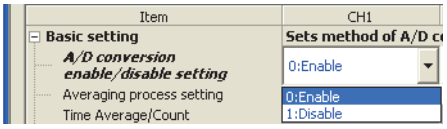
The following figure shows the graph of the input signal error detection value in the above case. (Since the setting value is "100(10.0%)", the error is detected not only at 2.4mA, but also at 21.6mA.)



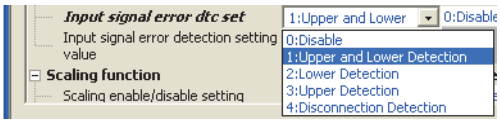
(8) Setting procedure

1. Set "A/D conversion enable/disable setting" to "0: Enable".

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



2. Set a detection method in "Input signal error detection setting".



3. Set a value in "Input signal error detection setting value".



Item	Setting range
Input signal error detection setting value	0 to 25.0%

Point

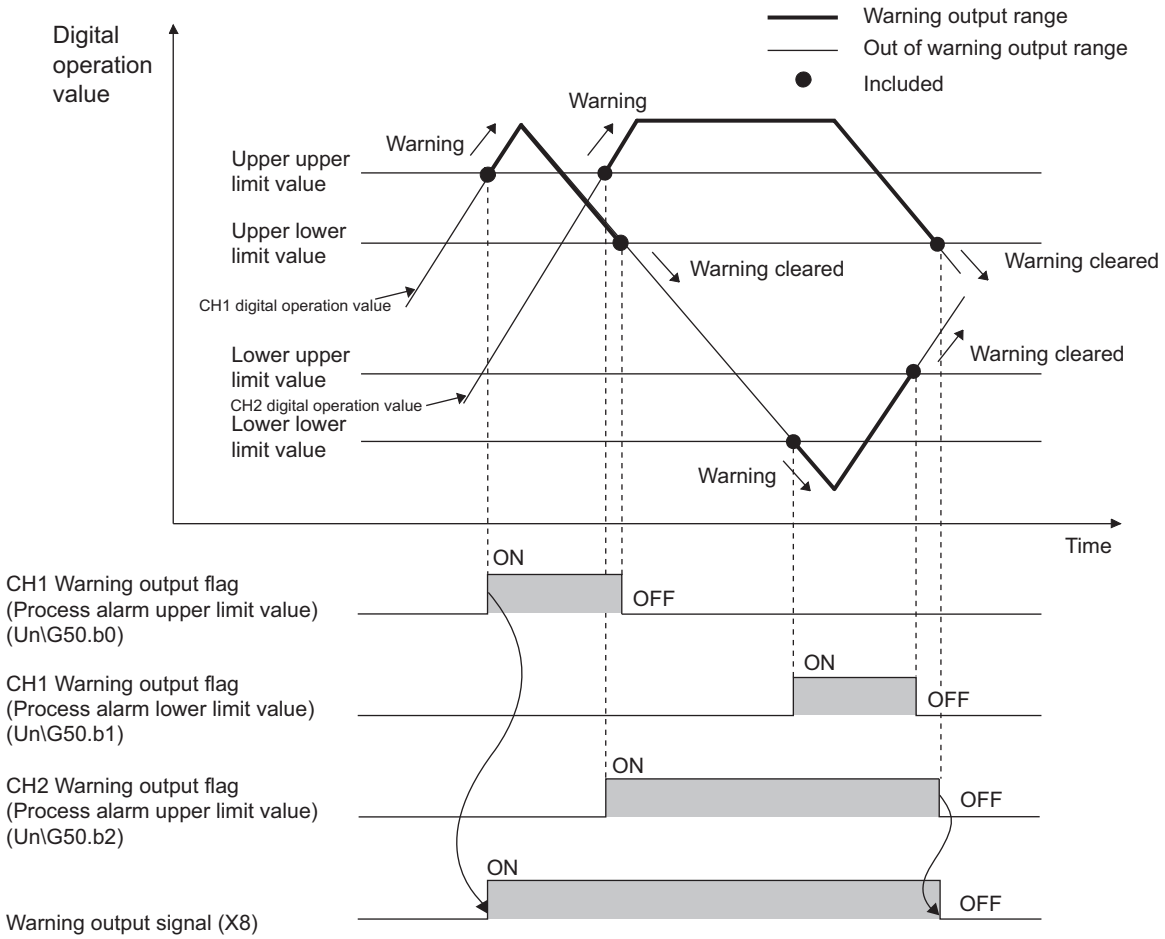
When "4: Disconnection Detection" is set to a channel whose input range is not 4 to 20mA (Extended mode) or 1 to 5V (Extended mode), an error occurs. Error code (82☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on.

8.8 Warning Output Function

This section describes process alarms and rate alarms used as the warning output function.

8.8.1 Process alarm

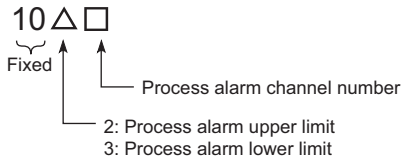
This function outputs a warning when a digital operation value enters the preset range.



(1) Operation when a warning is output

When a digital operation value is equal to or greater than the process alarm upper upper limit value, or the value is equal to or smaller than the process alarm lower lower limit value and hence the value is within the warning output range, a warning is output as follows.

- Alarm ON (1) is stored in Warning output flag (Process alarm) (Un\G50).
- Warning output signal (X8) turns on.
- The ALM LED turns on.
- Alarm code (10 △□) is stored in Latest error code (Un\G19).
  The following figure shows the alarm code stored.



However, digital conversion continues on the channel where a warning was output.

(2) Operation after a warning was output

When a digital operation value is smaller than the process alarm upper lower limit value or larger than the process alarm lower upper limit value and thus return to within the setting range after a warning is output, 0 is stored to the corresponding channel number bit of Warning output flag (Process alarm) (Un\G50).
When digital output values in all the channels are within the setting range, Warning output signal (X8) turns off and the ALM LED turns off.

However, alarm code (10 △□) stored in Latest error code (Un\G19) is not cleared. Turn on then off Error clear request (YF) to clear alarm code (10 △□).

(3) Detection cycle

When time average is specified, the function works at every interval of the average time. When count average is specified, the function works at every average count.
When the sampling processing, moving average, the time lag filter, the low pass filter, the high pass filter, or the band pass filter is specified, the function works on the sampling cycle.

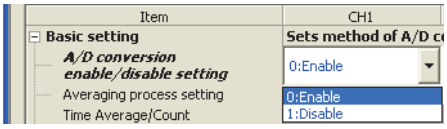
(4) Target value for warning output

CH□ Digital operation value (Un\G54 to Un\G57) is the target value for process alarms.
Set values for CH1 Process alarm lower lower limit value (Un\G86) to CH4 Process alarm upper upper limit value (Un\G101) considering digital clipping, scale conversion, shift conversion, and difference conversion.

(5) Setting procedure

1. Set "A/D conversion enable/disable setting" to "0: Enable".

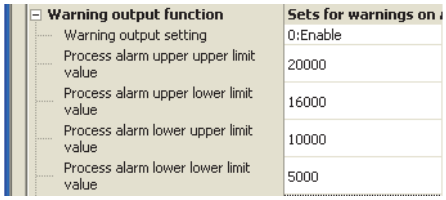
Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



2. Set "Warning output setting" to "0: Enable".



3. Set values to "Process alarm upper upper limit value", "Process alarm upper lower limit value", "Process alarm lower upper limit value", and "Process alarm lower lower limit value".



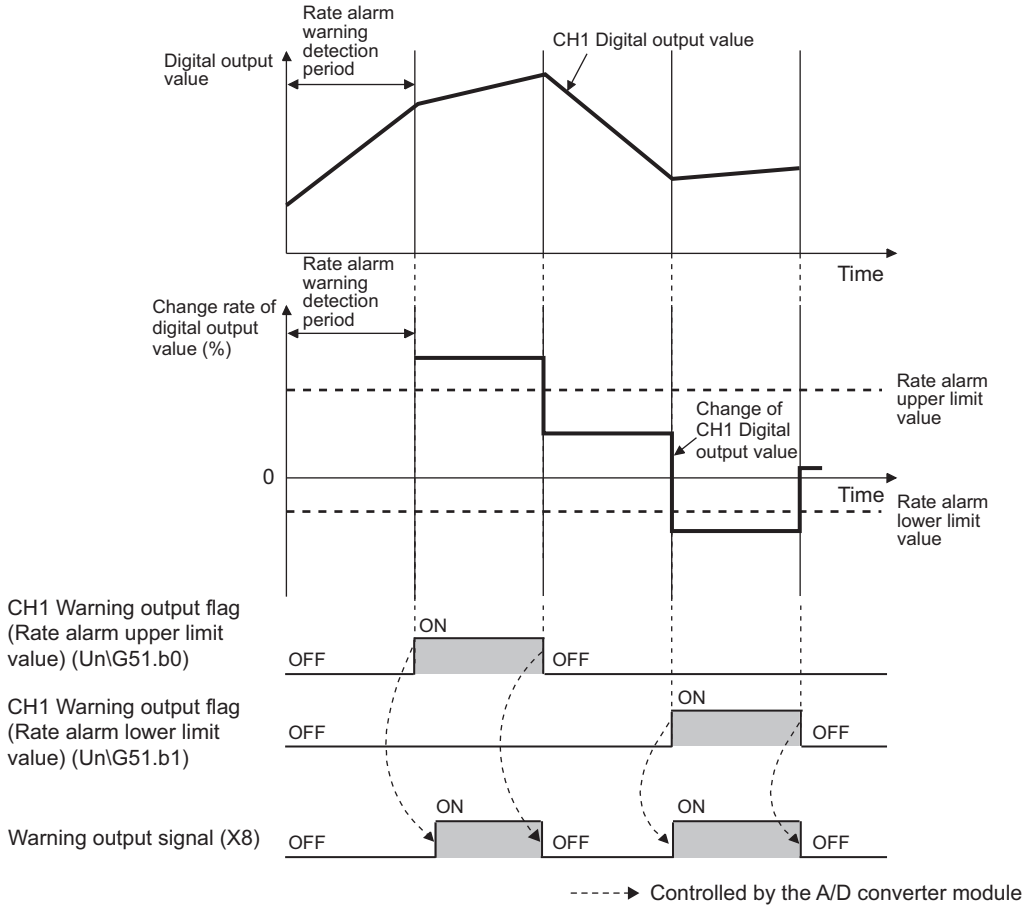
Item	Setting range
Process alarm upper upper limit value	-32768 to 32767
Process alarm upper lower limit value	
Process alarm lower upper limit value	
Process alarm lower lower limit value	

Point

The warning output setting must meet the following condition:
Process alarm upper upper limit value ≥ Process alarm upper lower limit value ≥ Process alarm lower upper limit value ≥ Process alarm lower lower limit value

8.8.2 Rate alarm

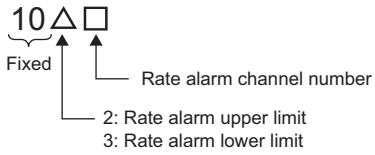
When a change rate of a digital output value is equal to or more than the rate alarm upper limit value (%/s) or the rate is equal to or less than the rate alarm lower limit value (%/s), a warning is output.



(1) Operation when a warning is output

Digital output values are monitored on the rate alarm detection cycle, and when a change rate of a digital output value (from a previous value) is equal to or more than the rate alarm upper limit value (%/s), or the rate is equal to or less than the rate alarm lower limit value (%/s), a warning is output as follows.

- Alarm ON (1) is stored in Warning output flag (Rate alarm) (Un\G51).
- Warning output signal (X8) turns on.
- The ALM LED turns on.
- Alarm code (10 △□) is stored in Latest error code (Un\G19).
  The following shows the alarm code stored.



However, digital conversion continues on the channel where a warning was output.

(2) Operation after a warning was output

When a digital output value is smaller the rate alarm upper limit value or larger than the rate alarm lower limit value and return to within the setting range after a warning is output, 0 is stored to the corresponding channel number bit of Warning output flag (Rate alarm) (Un\G51).

When all the channels return to within the setting range, Warning output signal (X8) turns on and the ALM LED turns off.

However, alarm code (10 △□) stored in Latest error code (Un\G19) is not cleared. Turn on then off Error clear request (YF) to clear alarm code (10 △□).

(3) Detection cycle

Set the rate alarm detection cycle in the rate alarm detection cycle setting.

The rate alarm detection cycle is calculated by multiplying the set value by the conversion cycle.

Ex. The rate alarm detection cycle under the following conditions

- A/D conversion-enabled channels: CH1 to CH3
- CH1 Rate alarm detection cycle: 5 (times)

The rate alarm detection cycle is 400μs. (80μs × 5 (Times)) A digital output value is compared in 400μs intervals to check the change rate.

(4) Judgment of rate alarm

A change rate is judged with the rate alarm upper limit value and the rate alarm lower limit value converted to digital values per rate alarm detection cycle.
The following shows the conversion formula of judgment value for rate alarm detection.

$$\text{Judgement value for rate alarm detection (digit)} = \left(\frac{R_H \text{ or } R_L}{1000} \right) \times D_{Max}$$

Item	Description
R_H	Rate alarm upper limit value (Unit: 0.1%)
R_L	Rate alarm lower limit value (Unit: 0.1%)
D_{Max}	Maximum digital output value of the input range: 32000

Point

Values after the decimal point are omitted.

Ex. The judgment value under the following conditions

- A/D conversion-enabled channels: CH1
- Averaging process setting: Sampling processing
- CH1 Rate alarm detection cycle setting value: 10 (times)
- CH1 Rate alarm upper limit value: 250 (25.0%)
- CH1 Rate alarm lower limit value: 50 (5.0%)

250 × 0.001 × 32000 = 8000 (digit)
50 × 0.001 × 32000 = 1600 (digit)

The present value is compared to the previous value in a rate alarm detection cycle of 400µs (sampling cycle × 10).
A digital value is judged if it increases 8000digits (25.0%) or more, or judged if the increase is 1600digits or less (5%) from the previous value. (when the maximum digital output value is 32000)

Use the following formula to calculate a change rate to be set with the change amount of voltage and current to detect a warning.

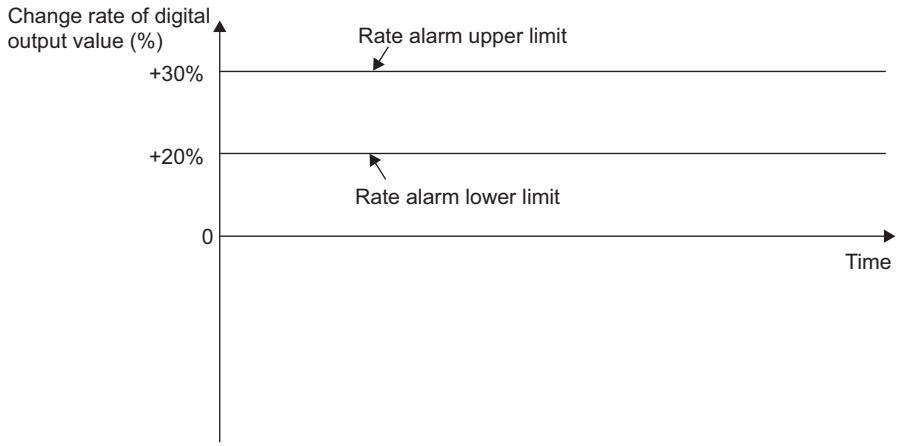
$$\text{Change rate to be set (0.1\%)} = \left(\frac{\text{Change amount of the voltage (current) to detect a warning (V(mA))}}{\text{Gain voltage (current) (V(mA)) - Offset voltage (current) (V(mA))}} \times 1000 \right)^{*1}$$

*1 Values after the decimal point are omitted.

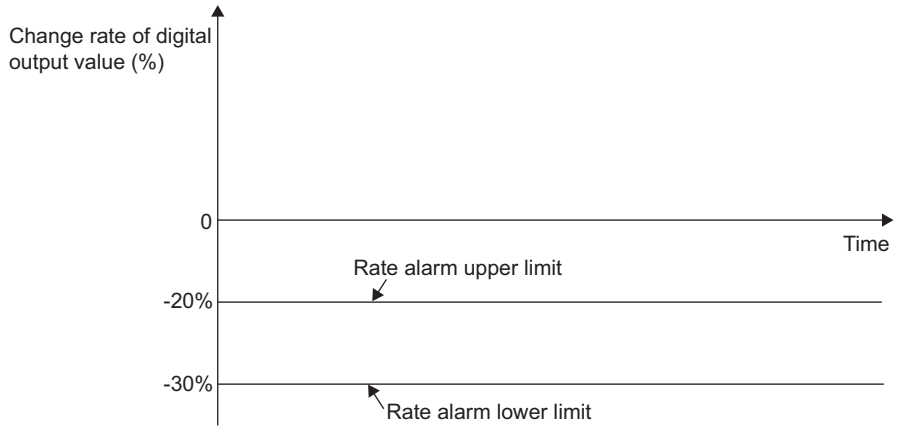
(5) Examples to use a rate alarm

The change rate of digital output values in a limited range can be monitored easily as follows:

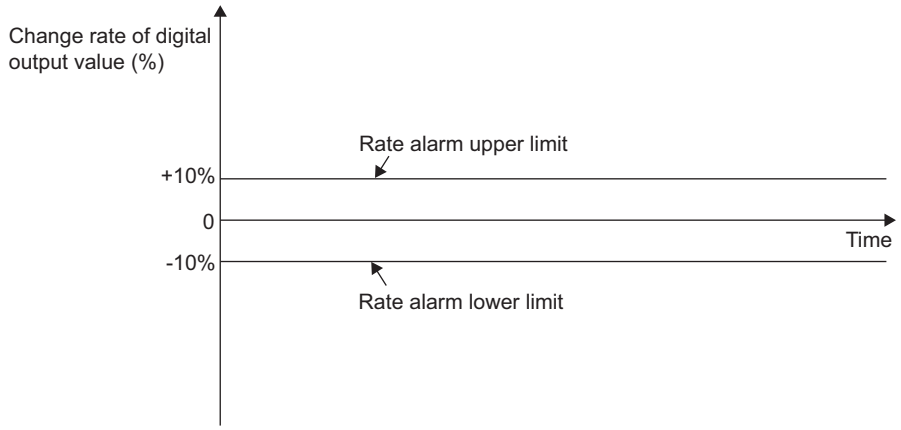
Ex. 1: To monitor that a rising rate of a digital output value is within the specified range



Ex. 2: To monitor that a drop rate of a digital output value is within the specified range



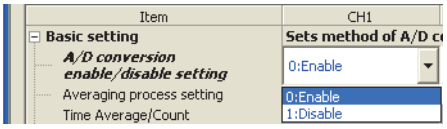
Ex. 3: To monitor that a change rate of a digital output value is within the specified range



(6) Setting procedure

1. Set "A/D conversion enable/disable setting" to "0: Enable".

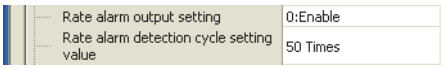
Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



2. Set "Rate alarm output setting" to "0: Enable".



3. Set a value to "Rate alarm detection cycle setting value".

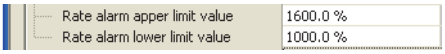


Item	Setting value
Rate alarm detection cycle setting value	1 to 32000 (Times)

Point

An error occurs when a value out of the above setting range is set. Error code (71☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on.

4. Set values to "Rate alarm upper limit value" and "Rate alarm lower limit value".



Item	Setting value
Rate alarm upper limit value	-3276.8 to 3276.7%
Rate alarm lower limit value	

Point

- Ser the rate alarm upper limit value and the rate alarm lower limit value in a unit of 0.1% of the digital output value corresponding to the rate alarm upper limit value.
- The rate alarm setting must meet the following condition:
  Rate alarm upper limit value > Rate alarm lower limit value
- An error occurs when a value out of the above setting range is set. Error code (70☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on.

8.9 Scaling Function

This function enables scale conversion on the output digital values. The values are converted within the range of the set scaling upper limit value and scaling lower limit value.
The converted values are stored in CH□ Digital operation value (Un\G54 to Un\G57).

(1) Concept of scaling setting

Ex. When the input range is set to -10 to 10V:
For the scaling lower limit value, set a value corresponding to the lower limit of the input range (-32000), and for the scaling upper limit value, set a value corresponding to the upper limit of the input range (32000).

(2) Calculation of the digital operation value

For A/D conversion, use the values produced by the following formulas. (Values after the decimal point are omitted during scale conversion.)

- Voltage : 0 to 10V, 0 to 5V, 1 to 5V, user range setting (bi-polar: voltage), 1 to 5V (Extended mode)*1
- Current : 0 to 20mA, 4 to 20mA, user range setting (uni-polar: current), 4 to 20mA (Extended mode)*1

$$\text{Digital operation value} = \frac{D_X \times (S_H - S_L)}{32000} + S_L$$

- Voltage : -10 to 10V

$$\text{Digital operation value} = \frac{D_X \times (S_H - S_L)}{64000} + \frac{(S_H + S_L)}{2}$$

Item	Description
D_X	Digital output value
S_H	Scaling upper limit value
S_L	Scaling lower limit value

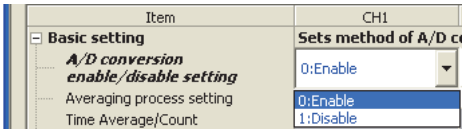
*1 Although the digital output value range in the extended mode is -8000 to 32000, this function scales digital output values within the range of 0 to 32000. For the example of scaling setting with the extended mode, refer to the following.

• Example of scaling setting(☞Page 112, Section 8.9 (4))

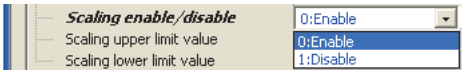
(3) Setting procedure

1. Set "A/D conversion enable/disable setting" to "0: Enable".

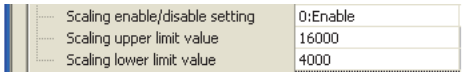
Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



2. Set "Scaling enable/disable setting" to "0: Enable".



3. Set values for "Scaling upper limit value" and "Scaling lower limit value".



Item	Setting range
Scaling upper limit value	-32000 to 32000
Scaling lower limit value	

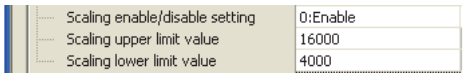
Point

- Even when the scaling upper limit value and the scaling lower limit value are set so that the change is greater than the resolution, the resolution will not increase.
- Scaling setting must meet the following condition:
  Scaling upper limit value > Scaling lower limit value

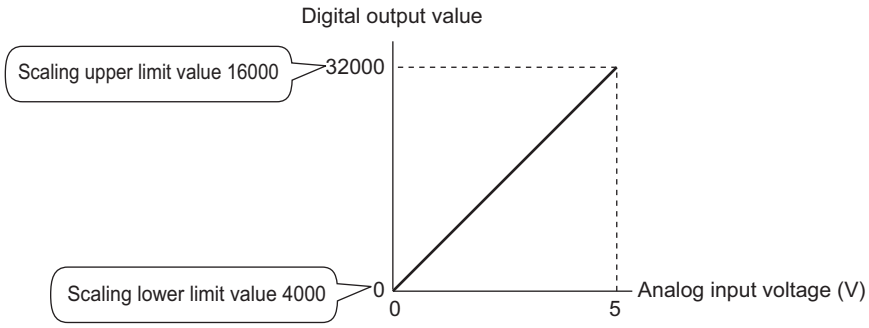
(4) Example of scaling setting

Ex. 1: When the following values are set for a channel with an input range of 0 to 5V:

- "Scaling enable/disable setting": "0: Enable"
- "Scaling upper limit value": 16000
- "Scaling lower limit value": 4000



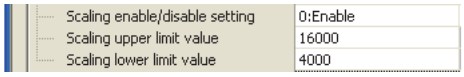
The following figure and table show the digital output values and digital operation values.



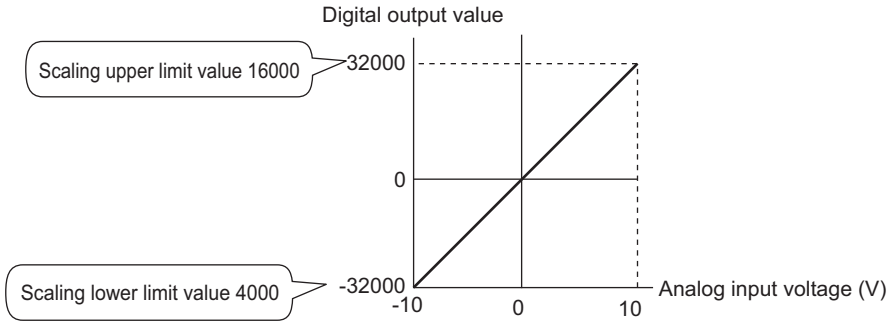
Analog input voltage (V)	Digital output value	Digital operation value
0	0	4000
1	6400	6400
2	12800	8800
3	19200	11200
4	25600	13600
5	32000	16000

Ex. 2: When the following values are set for a channel with an input range of -10 to 10V:

- "Scaling enable/disable setting": "0: Enable"
- "Scaling upper limit value": 16000
- "Scaling lower limit value": 4000



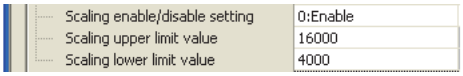
The following figure and table show the digital output values and digital operation values.



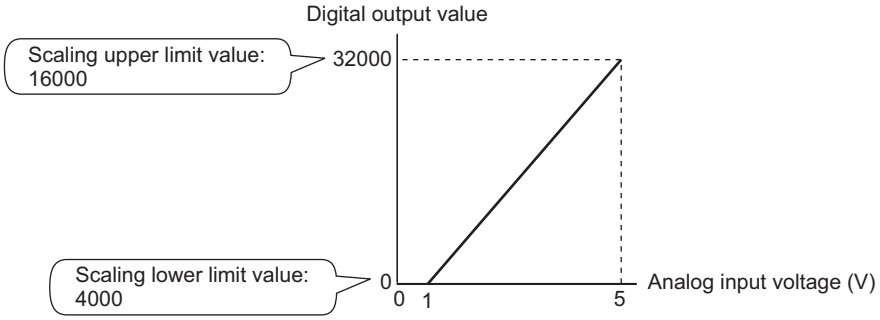
Analog input voltage (V)	Digital output value	Digital operation value
-10	-32000	4000
-5	-16000	7000
0	0	10000
5	16000	13000
10	32000	16000

Ex. 3: When the following values are set for a channel with an input range of 1 to 5V (Extended mode):

- "Scaling enable/disable setting": "0: Enable"
- "Scaling upper limit value": 16000
- "Scaling lower limit value": 4000



The following figure and table show the digital output values and digital operation values.



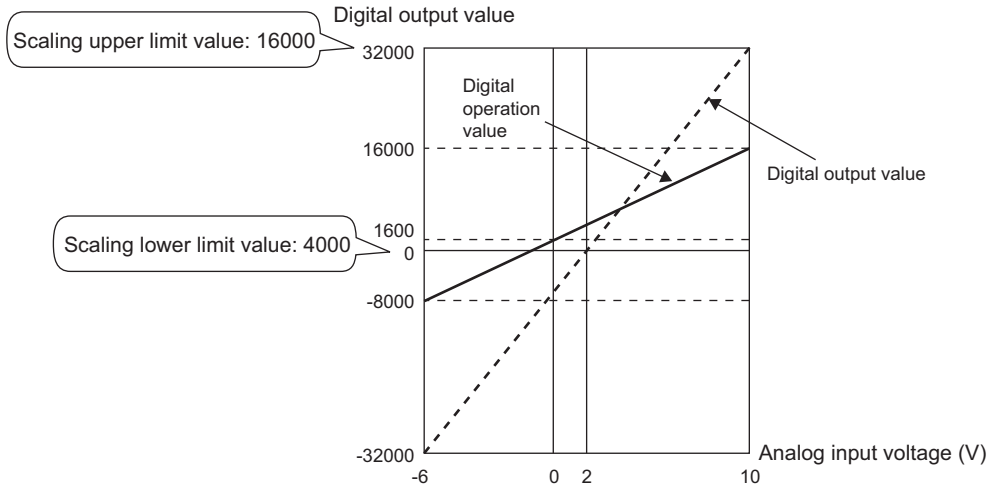
Analog input voltage (V)	Digital output value	Digital operation value
0	-8000	1000
1	0	4000
2	8000	7000
3	16000	10000
4	24000	13000
5	32000	16000
5.5	32767	16287

Ex. 4: When the following values are set for a channel with a user range setting (bi-polar: voltage) of 2 to 10V:

- "Scaling enable/disable setting": "0: Enable"
- "Scaling upper limit value": 16000
- "Scaling lower limit value": 4000

Scaling enable/disable setting	0:Enable
Scaling upper limit value	16000
Scaling lower limit value	4000

The following figure and table show the digital output values and digital operation values.



Analog input voltage (V)	Digital output value	Digital operation value
-6	-32000	-8000
-4	-24000	-5000
-2	-16000	-2000
0	-8000	1000
2	0	4000
4	8000	7000
6	16000	10000
8	24000	13000
10	32000	16000

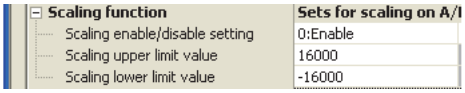
Point

When the scaling function is used with the digital clipping function, scale conversion is executed on the digital operation values after digital clipping.

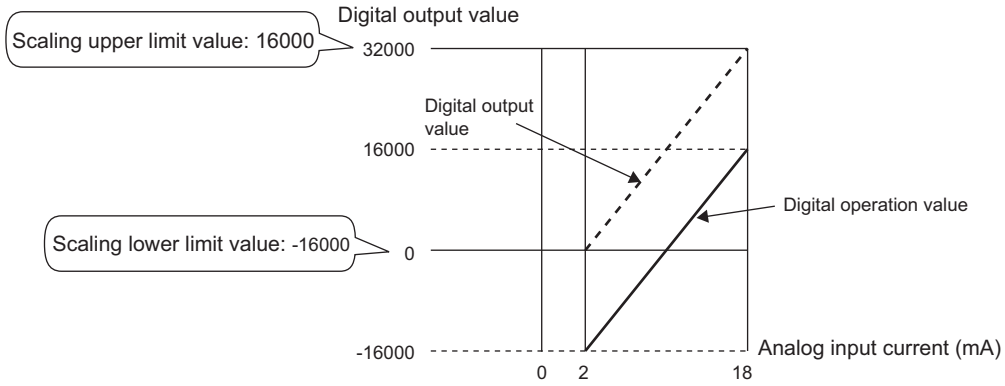
- Processing Each Function (Page 71, Section 8.2)

Ex. 5: When the following values are set for a channel with a user range setting (uni-polar: current) of 2 to 18mA:

- "Scaling enable/disable setting": "0: Enable"
- "Scaling upper limit value": 16000
- "Scaling lower limit value": -16000



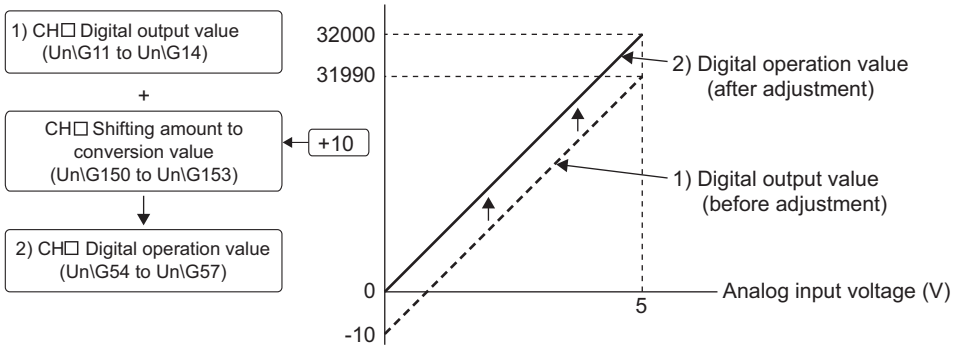
The following figure and table show the digital output values and digital operation values.



Analog input current (mA)	Digital output value	Digital operation value
2	0	-16000
6	8000	-8000
10	16000	0
14	24000	8000
18	32000	16000

8.10 Shift Function

This function adds (shifts) a set shifting amount to conversion value to the digital output value and stores the result in the buffer memory. The digital operation value reflects the change in the shifting amount to conversion value on a real-time basis. Therefore, fine adjustment can be easily performed when the system starts.



Input voltage (V)	CH☐ Digital output value (Un\G11 to Un\G14)
0	-10
5	31990

Input voltage (V)	CH☐ Digital operation value (Un\G54 to Un\G57)
0	0
5	32000

(1) Operation of the shift function

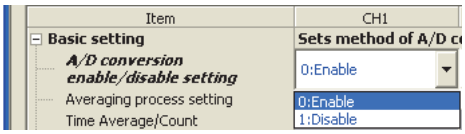
A set shifting amount to conversion value is added to the digital operation value. The digital operation value with shift addition is stored in CH☐ Digital operation value (Un\G54 to Un\G57). The shift amount is added in every sampling cycle for sampling processing and is added in every averaging process cycle for averaging processing. Then, those added values are stored in CH☐ Digital operation value (Un\G54 to Un\G57).

If a value is set to the shift amount (to conversion value), the shifting amount to conversion value is added regardless of turning on then off Operating condition setting request (Y9).

(2) Setting procedure

1. Set "A/D conversion enable/disable setting" to "0: Enable".

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



2. Set a value to "Shifting amount to conversion value".



Item	Setting range
Shifting amount to conversion value	-32768 to 32767

Point

If the digital output value exceeds the range of -32768 to 32767 as a result of shift addition, the digital output value is fixed to the lower limit value (-32768) or the upper limit value (32767).

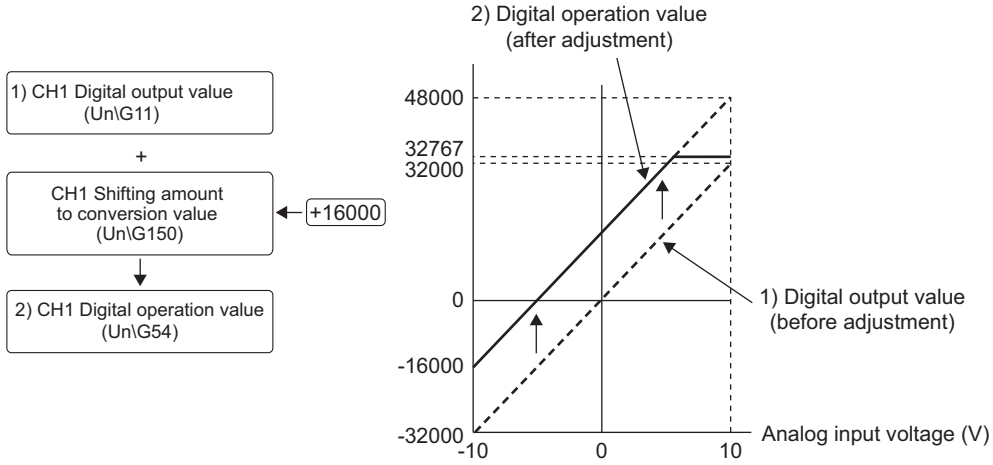
(3) Setting example

Ex. When the following values are used for a channel with an input range of -10 to 10V:

- "Shifting amount to conversion value": 16000



The following figure and table show the values stored in CH1 Digital output value (Un\G11) and CH1 Digital operation value (Un\G54).



Analog input voltage (V)	CH1 Digital output value (Un\G11)	CH1 Digital operation value (Un\G54)
-10	-32000	-16000
-5	-16000	0
0	0	16000
5	16000	32000
10	32000	32767*1

*1 Because the value exceeds the range of -32768 to 32767, the value is fixed to 32767 (the upper limit value).

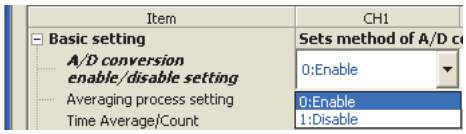
(4) Setting example of when both the scaling function and shift function are used

Ex. When the following values are used for the A/D converter module with an input range of 0 to 5V:

- "Scaling enable/disable setting": "0: Enable"
- "Scaling upper limit value": 12000
- "Scaling lower limit value": 2000
- "Shifting amount to conversion value": 2000

1. Set "A/D conversion enable/disable setting" to "0: Enable".

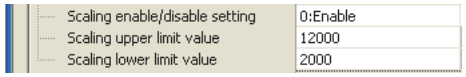
Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



2. Set "Scaling enable/disable setting" to "0: Enable".



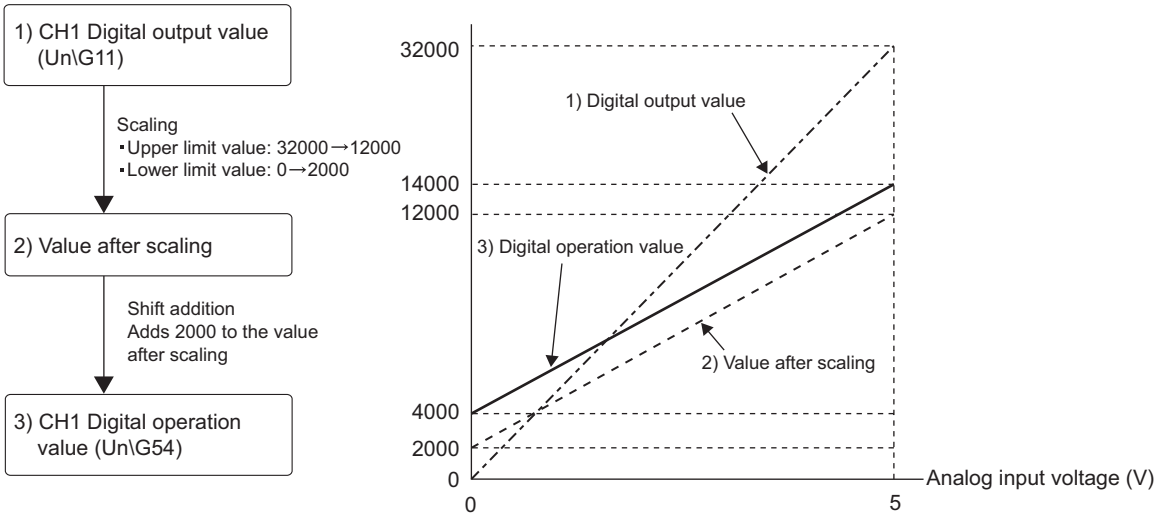
3. Set values for "Scaling upper limit value" and "Scaling lower limit value".



4. Set a value to "Shifting amount to conversion value".



The following figure and table show the values stored in CH1 Digital output value (Un\G11) and CH1 Digital operation value (Un\G54).



Analog input voltage (V)	CH1 Digital output value (Un\G11)	Value after scaling	CH1 Digital operation value (Un\G54)
0	0	2000	4000
1	6400	4000	6000
2	12800	6000	8000
3	19200	8000	10000
4	25600	10000	12000
5	32000	12000	14000

Point

When the shift function is used with the digital clipping function and scaling function, shift addition is executed on the value obtained after digital clipping and scale conversion. Therefore, the range of the digital operation value is determined as - 32768 to 32767.

For a setting example of when the digital clipping function, scaling function, and shift function are used together, refer to the following.

- Setting example of when the digital clipping function, scaling function, and shift function are used together (Page 124, Section 8.11 (4))

8.11 Digital Clipping Function

This function fixes the range of the digital operation value with the maximum digital output value and the minimum digital output value when the corresponding current or voltage exceeds the input range.

(1) Concept of digital clipping setting

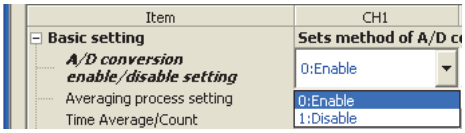
The following table lists the output range of the digital operation value when the digital clipping function is enabled for each range.

Input range	Output range of the digital operation value	
	Digital clipping function enabled	Digital clipping function disabled
4 to 20mA	0 to 32000	-768 to 32767
0 to 20mA		
1 to 5V		
0 to 5V		
0 to 10V		
User range setting (uni-polar: current)		
-10 to 10V	-32000 to 32000	-32768 to 32767
User range setting (bi-polar: voltage)		
4 to 20mA (Extended mode) 1 to 5V (Extended mode)	-8000 to 32000	-8768 to 32767

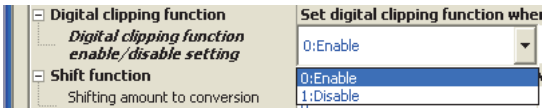
(2) Setting procedure

1. Set "A/D conversion enable/disable setting" to "0: Enable".

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



2. Set "Digital clipping function enable/disable setting" to "0: Enable".



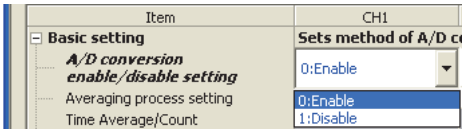
(3) Setting example of when both the digital clipping function and scaling function are used

Ex. When the following values are used for the A/D converter module with an input range of 0 to 5V:

- "Scaling enable/disable setting": "0: Enable"
- "Scaling upper limit value": 32000
- "Scaling lower limit value": 0
- "Digital clipping function enable/disable setting": "0: Enable"

1. Set "A/D conversion enable/disable setting" to "0: Enable".

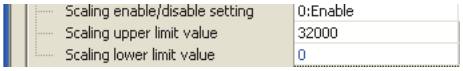
Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



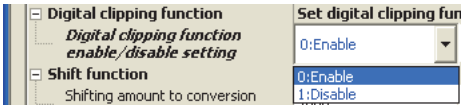
2. Set "Scaling enable/disable setting" to "0: Enable".



3. Set values for "Scaling upper limit value" and "Scaling lower limit value".



4. Set "Digital clipping function enable/disable setting" to "0: Enable".



In this case, scale conversion is performed on the digital-clipped digital operation value. Therefore, the digital output range of the digital operation value is determined as 0 to 32000.

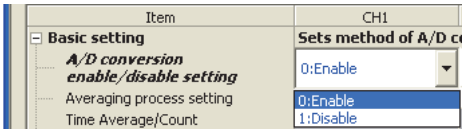
(4) Setting example of when the digital clipping function, scaling function, and shift function are used together

Ex. When the following values are used for the A/D converter module with an input range of 0 to 5V:

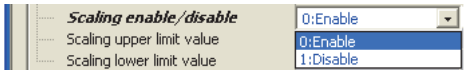
- "Scaling enable/disable setting": "0: Enable"
- "Scaling upper limit value": 12000
- "Scaling lower limit value": 2000
- "Shifting amount to conversion value": 2000
- "Digital clipping function enable/disable setting": "0: Enable"

1. Set "A/D conversion enable/disable setting" to "0: Enable".

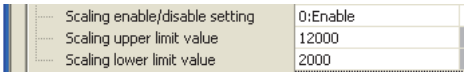
Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



2. Set "Scaling enable/disable setting" to "0: Enable".



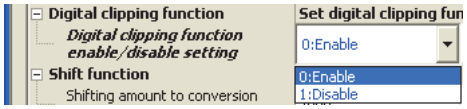
3. Set values for "Scaling upper limit value" and "Scaling lower limit value".



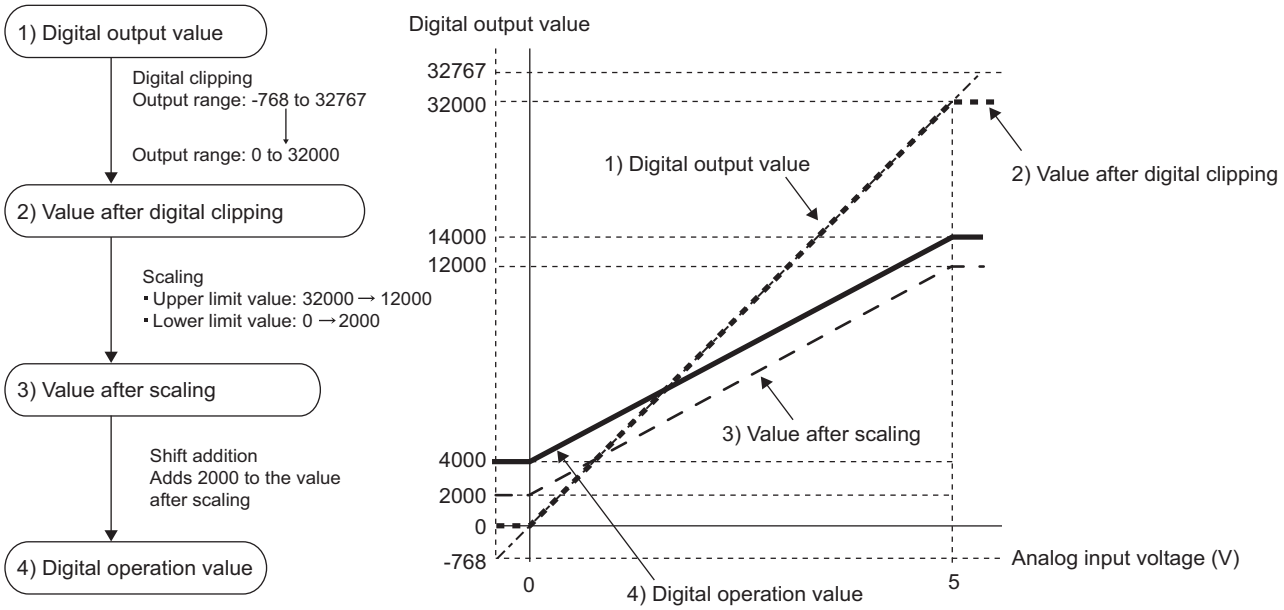
4. Set a value to "Shifting amount to conversion value".



5. Set "Digital clipping function enable/disable setting" to "0: Enable".



The following figure and table show the values stored in the digital output values and digital operation values.



Analog input voltage (V)	Digital output value	Digital operation value
-0.12	-768	4000
0	0	4000
1	6400	6000
2	12800	8000
3	19200	10000
4	25600	12000
5	32000	14000
5.12	32767	14000

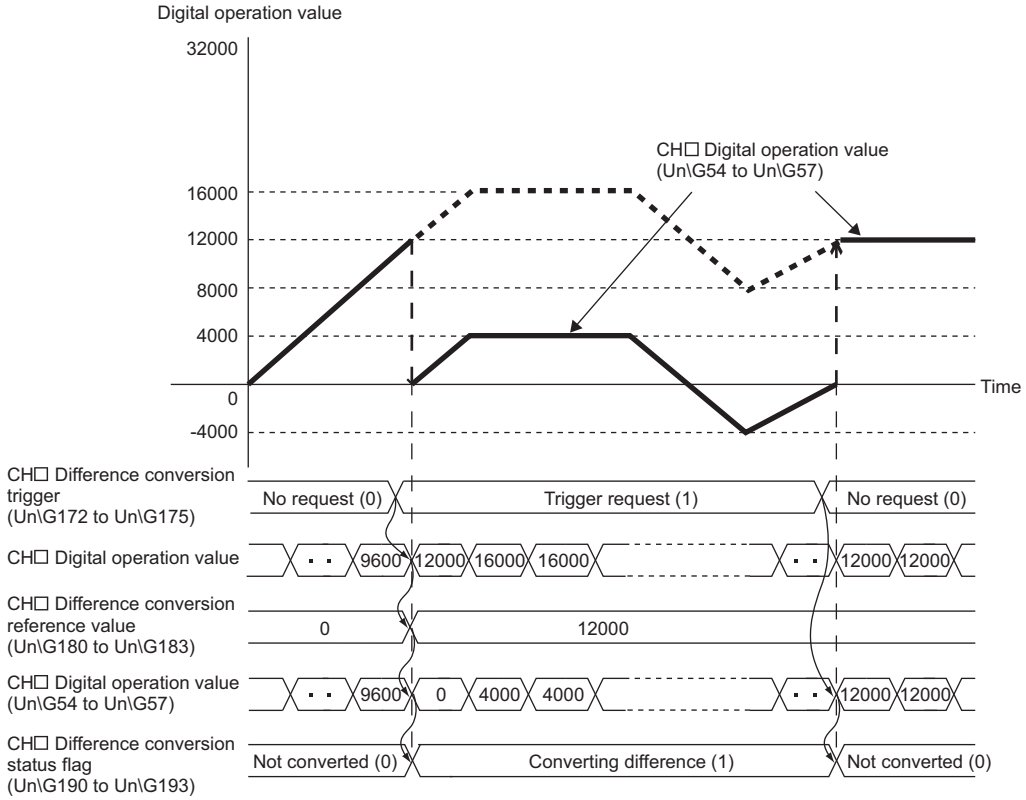
Point

When the digital clipping function is used with the scaling function, shift function, and difference conversion function, scale conversion, shift addition, and difference conversion are executed on the value obtained after digital clipping.
For details, refer to the following.

- Processing Each Function (☞ Page 71, Section 8.2)

8.12 Difference Conversion Function

The digital operation value at the start of this function is treated as 0 (reference value). Thereafter, values that increase or decrease from the reference value are stored in the buffer memory.



(1) Operation of the difference conversion function

The digital operation value at the difference conversion start (the data stored inside the A/D converter module before difference conversion starts) is determined as a difference conversion reference value. The value acquired by subtracting the difference conversion reference value from the digital operation value is stored in CH☐ Digital operation value (Un\G54 to Un\G57). CH☐ Digital operation value (Un\G54 to Un\G57) at the start of this function is 0. (since the digital operation value equals the difference conversion reference value at the start)

Digital operation value after difference conversion = Digital operation value - Difference conversion reference value

(2) How to use difference conversion

(a) Starting difference conversion

1. **Change CH☐ Difference conversion trigger (Un\G172 to Un\G175) from No request (0) to Trigger request (1).**

The rise of No request (0) → Trigger request (1) is detected as a trigger. When the trigger is detected, the digital operation value at the start is output to the difference conversion reference value. The value acquired by subtracting the difference conversion reference value from the digital operation value is stored in CH☐ Digital operation value (Un\G54 to Un\G57). After the value is stored, CH☐ Difference conversion status flag (Un\G190 to Un\G193) changes to Converting difference (1).

(b) Stopping difference conversion

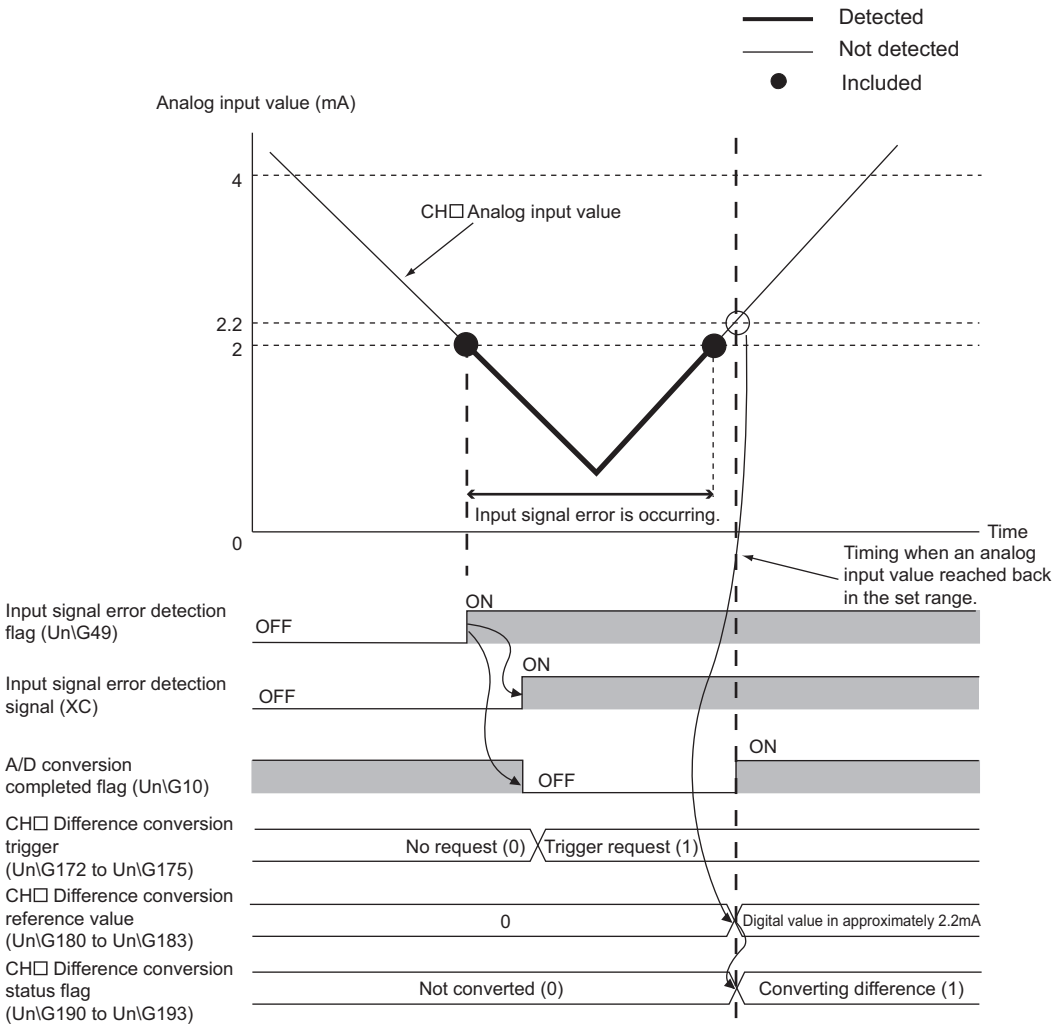
1. **Change CH□ Difference conversion trigger (Un\G172 to Un\G175) from Trigger request (1) to No request (0).**

The fall of Trigger request (1) → No request (0) is detected as a trigger. When the trigger is detected, the difference conversion stops, and CH□ Difference conversion status flag (Un\G190 to Un\G193) changes to Not converted (0). After that, the digital operation value is stored as it is in CH□ Digital operation value (Un\G54 to Un\G57).

(3) Points for the use of the difference conversion function

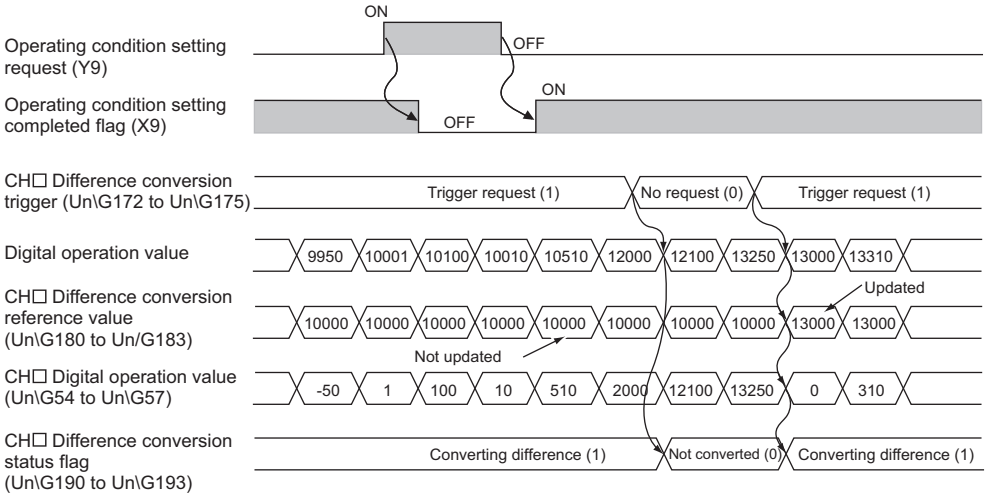
(a) Operation of when an input signal error occurs

When an input signal error occurs, even if CH□ Difference conversion trigger (Un\G172 to Un\G175) changes from No request (0) to Trigger request (1), the difference conversion does not start. After the analog input value returns within the setting range, change CH□ Difference conversion trigger (Un\G172 to Un\G175) from No request (0) to Trigger request (1) again. If an input signal error occurs in the status of Trigger request (1), the difference conversion starts just when the analog input value returns within the setting value, treating the digital operation value as the difference conversion reference value.



(b) Operation of when Operating condition setting request (Y9) is turned on then off during difference conversion

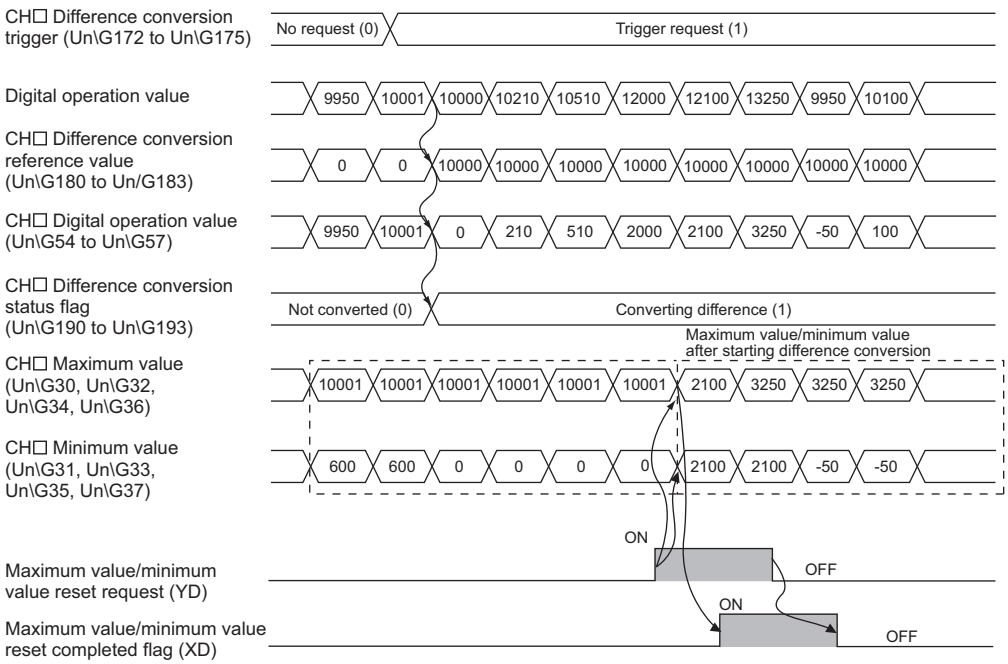
- During the difference conversion, even when Operating condition setting request (Y9) is turned on then off, the difference conversion continues without refreshing the difference conversion reference value. To refresh the difference conversion reference value, restart the difference conversion by changing CH☐ Difference conversion trigger (Un\G172 to Un\G175) from Trigger request (1) to No request (0), then Trigger request (1) again.
- CH☐ Difference conversion trigger (Un\G172 to Un\G175) does not become valid even when the trigger changes from No request (0) to Trigger request (1) when Operating condition setting request (Y9) is turned off then on. After turning on then off Operating condition setting request (Y9), change CH☐ Difference conversion trigger (Un\G172 to Un\G175) from No request (0) to Trigger request (1) again.



(c) Operation of the maximum value and the minimum value

When the difference conversion starts, the maximum value and the minimum value of the values acquired by the difference conversion are stored in CH□ Maximum value (Un\G30, Un\G32, Un\G34, Un\G36) and CH□ Minimum value (Un\G31, Un\G33, Un\G35, Un\G37). By turning on Maximum value/minimum value reset request (YD), the maximum value and the minimum value after the start of the difference conversion can be checked.

When Maximum value/minimum value reset request (YD) is not turned on, the maximum values and minimum values before and after difference conversion are mixed.


CH□ Difference conversion trigger (Un\G172 to Un\G175)
No request (0)
Trigger request (1)
Digital operation value
9950 10001 10000 10210 10515 12000 12100 13250 9950 10100
CH□ Difference conversion reference value (Un\G180 to Un/G183)
0 0 10000 10000 10000 10000 10000 10000 10000 10000
CH□ Digital operation value (Un\G54 to Un\G57)
9950 10001 0 210 510 2000 2100 3250 -50 100
CH□ Difference conversion status flag (Un\G190 to Un\G193)
Not converted (0)
Converting difference (1)
Maximum value/minimum value after starting difference conversion
CH□ Maximum value (Un\G30, Un\G32, Un\G34, Un\G36)
10001 10001 10001 10001 10001 10001 2100 3250 3250 3250
CH□ Minimum value (Un\G31, Un\G33, Un\G35, Un\G37)
600 600 0 0 0 0 2100 2100 -50 -50
ON
OFF
Maximum value/minimum value reset request (YD)
ON
OFF
Maximum value/minimum value reset completed flag (XD)

(d) Operation of when the averaging processing is set

If the difference conversion starts after the averaging processing is set, the digital operation value at the completion of the averaging processing is determined as the difference conversion reference value. In addition, CH□ Difference conversion status flag (Un\G190 to Un\G193) changes to Converting difference (1).

Point

- The difference conversion function can be started at any timing.
- When the difference conversion function is used with the digital clipping function, scaling function, and shift function, each digital operation value is determined as a difference conversion reference value.
- If a value other than No request (0) or Trigger request (1) is set in CH□ Difference conversion trigger (Un\G172 to Un\G175) during the difference conversion, an error occurs. Error code (37□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on. However, the difference conversion continues.

8.13 Logging Function

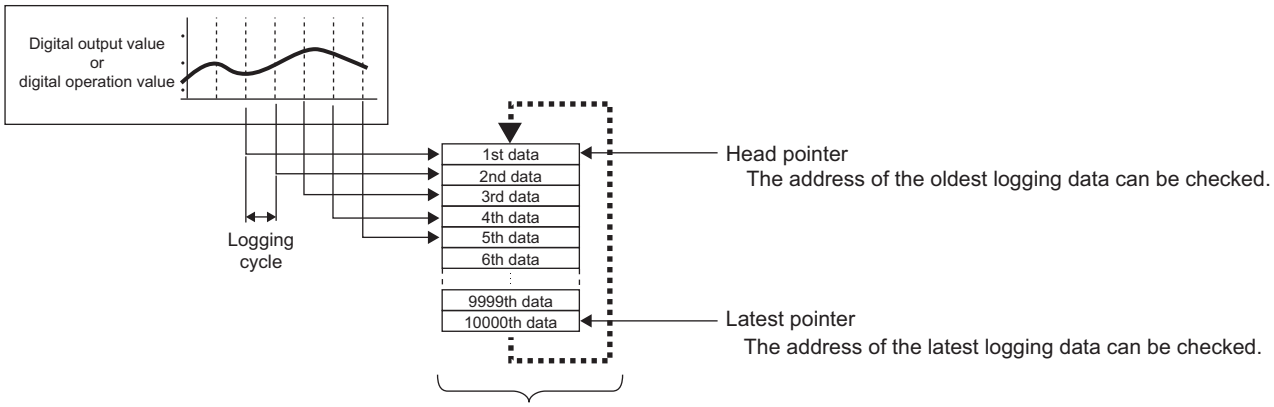
This function stores 10000 points of the digital output values in the buffer memory for each channel.
Up to 10000 points of data are stored to the buffer memory of the A/D converter module. However, with the logging load detection function, more than 10000 points of data can be stored by transferring the data to the file register of the CPU module.
In addition, maintainability of user's system can be increased by using the status change of the data as a trigger to stop logging and analyzing the data change to specify a trouble cause.
The data is refreshed at high speed during logging. Stop logging when the program needs to be used for reference.

(1) Logging function

(a) Collecting logging data

Logging data is collected during a fixed time period. A trouble cause (such as sudden change of the data) can be found by analyzing the data change. Logging data is collected as follows.

- 10000 points of digital output values or scaling operation values can be collected for each channel.
- More than 10000 points of logging data can be stored by transferring the data to the file register of the CPU module without stopping logging. (☞Page 137, Section 8.13.1)
- The data can be collected at intervals of 40μs at a minimum and of 3600s at a maximum.
- An address where the latest data is stored can be checked with the latest pointer.
- An address where the oldest data is stored can be checked with the head pointer.

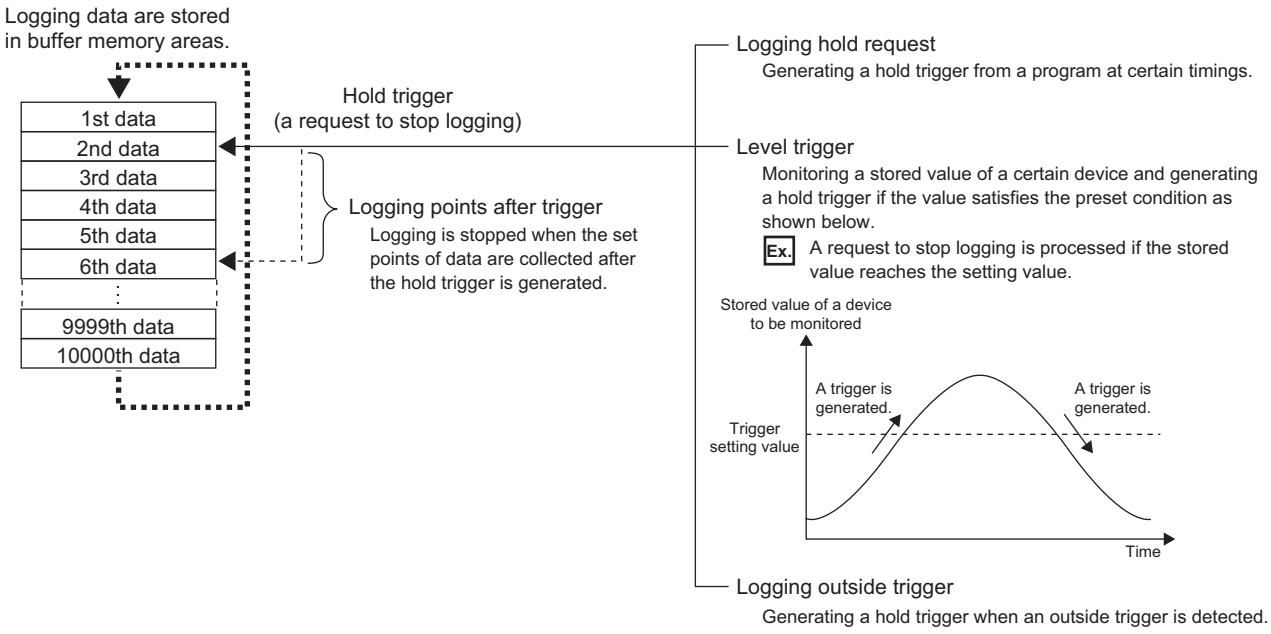


- Logging data are stored in buffer memory areas.
- The data are overwritten from the 1st data area when the 10000 points of data (maximum amount of data the memory can store) are stored.

(b) Stopping logging

Logging can be stopped by the following operations. Since the data after a hold trigger (a request to stop logging) occurs (a trouble occurs) can be saved, the data of the trouble cause can be quickly specified. (☞Page 148, Section 8.13.2)

- The status change in data is used as a trigger. Logging stops at a hold trigger to save the data after the trigger occurred. One of the following three signals can be selected as a hold trigger (a request to stop logging). Combination is not available.
  - Logging hold request
  - Level trigger
  - Logging outside trigger
- The number of logging data points to be collected after a hold trigger (a request to stop logging) occurs can be set.


Logging data are stored in buffer memory areas.
1st data
2nd data
3rd data
4th data
5th data
6th data
9999th data
10000th data
Hold trigger
(a request to stop logging)
Logging points after trigger
Logging is stopped when the set points of data are collected after the hold trigger is generated.
Logging hold request
Generating a hold trigger from a program at certain timings.
Level trigger
Monitoring a stored value of a certain device and generating a hold trigger if the value satisfies the preset condition as shown below.
Ex. A request to stop logging is processed if the stored value reaches the setting value.
Stored value of a device to be monitored
A trigger is generated.
A trigger is generated.
Trigger setting value
Time
Logging outside trigger
Generating a hold trigger when an outside trigger is detected.

(2) Application

(a) Storing more than 10000 points of data without stopping logging

More than 10000 points of data can be stored by transferring the logging data stored in the buffer memory of the A/D converter module to file registers of the CPU module without stopping logging.

The takt time of a test which requires high-speed conversion can be shortened. (☞Page 137, Section 8.13.1)

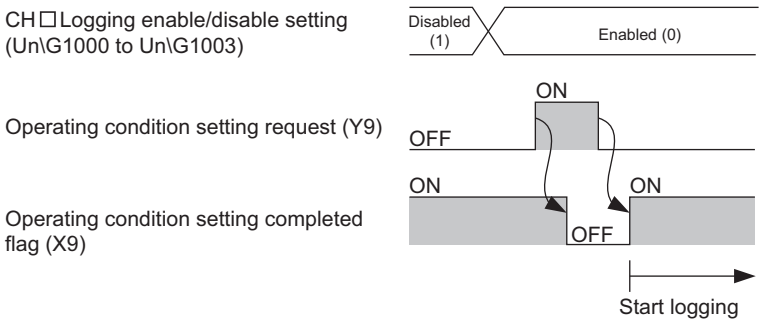
(b) Investigating error causes stopping logging and saving the data before and after an error occurs.

Since the data before and after a hold trigger (a request to stop logging) occurs (a trouble occurs) can be saved, the data of the trouble cause can be quickly specified. (☞Page 148, Section 8.13.2)

(3) Operation of logging

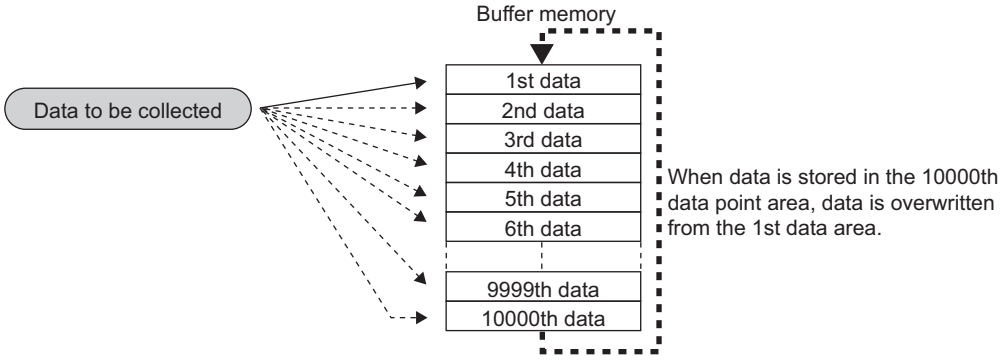
(a) Starting logging

Logging starts when CH☐ Logging enable/disable setting (Un\G1000 to Un\G1003) is set to Enabled (0) and Operating condition setting request (Y9) is turned on then off. Logging is performed on the preset logging cycle.



(b) Logging data

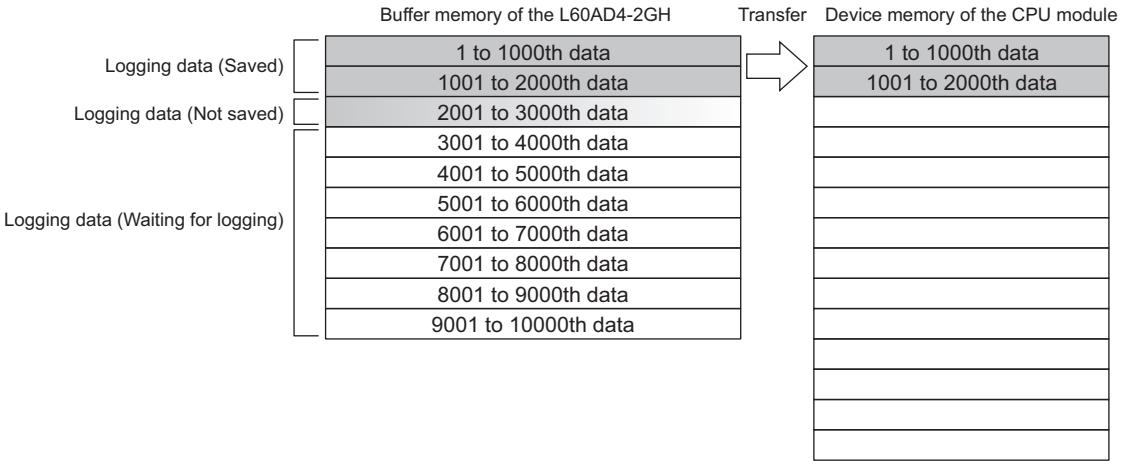
Logging data is stored to the following buffer memory areas for each channel.



Channel	Storage area for logging data
CH1	CH1 Logging data (Un\G5000 to Un\G14999)
CH2	CH2 Logging data (Un\G15000 to Un\G24999)
CH3	CH3 Logging data (Un\G25000 to Un\G34999)
CH4	CH4 Logging data (Un\G35000 to Un\G44999)

(c) When logging data stored in the buffer memory of the A/D converter module is transferred to the file registers of the CPU module

Ex. When 1000 points of the latest logging data are transferred to the device memory of the CPU module every time 1000 points of data are logged


Buffer memory of the L60AD4-2GH
Transfer
Device memory of the CPU module
Logging data (Saved)
Logging data (Not saved)
Logging data (Waiting for logging)
1 to 1000th data
1001 to 2000th data
2001 to 3000th data
3001 to 4000th data
4001 to 5000th data
5001 to 6000th data
6001 to 7000th data
7001 to 8000th data
8001 to 9000th data
9001 to 10000th data
1 to 1000th data
1001 to 2000th data

(4) Logging data setting

Select data type for each channel with CH□ Logging data setting (Un\G1024 to Un\G1027).

- Digital output value (0)
- Digital operation value (1)

(5) Logging cycle

Set the logging cycle for each channel with CH□ Logging cycle setting value (Un\G1032 to Un\G1035) and CH□ Logging cycle unit setting (Un\G1040 to Un\G1043).
Set the logging intervals to CH□ Logging cycle setting value (Un\G1032 to Un\G1035) and the unit of the logging intervals to CH□ Logging cycle unit setting (Un\G1040 to Un\G1043).

Setting value of CH□ Logging cycle unit setting (Un\G1040 to Un\G1043)	Setting range of CH□ Logging cycle setting value (Un\G1032 to Un\G1035)
μs(0)	40 to 32767
ms (1)	1 to 32767
s (2)	1 to 3600

The logging cycle must be an integral multiple of the conversion cycle. When the set logging cycle is not an integral multiple of the conversion cycle, the logging function operates in a maximum cycle which is an integral multiple within the setting range.
For the conversion cycle, refer to the following.

- Conversion cycle (☞Page 75, Section 8.4 (1) (c))

Ex. Under the following setting, the conversion cycle is 80μs and the actual logging cycle is 6960μs (an integral multiple of 80μs).

- A/D conversion-enabled channels: CH1 to CH3
- Averaging process setting: Sampling processing
- CH1 Logging cycle setting value: 7000
- CH1 Logging cycle unit setting: μS

960 is stored to CH1 Logging cycle monitor value (Un\G1124).
The logging function becomes disabled in the following conditions.
The logging function is disabled when even one of the following errors occurs after the logging function is enabled and Operating condition setting request (Y9) is turned on then off.

- Error code (20□): Setting error of CH□ Time Average/Count Average/Moving Average/Time lag filter constant (Un\G1 to Un\G4)
- Error code (30□): Setting error of CH□ Time Average/Count Average/Moving Average/Time lag filter constant (Un\G1 to Un\G4)
- Error code (31□): Setting error of CH□ Time Average/Count Average/Moving Average/Time lag filter constant (Un\G1 to Un\G4)
- Error code (200□ to 207□): Setting error of the parameter settings of the logging function
- Error code (250□ to 251□): Setting error of the parameter settings of the logging load detection function

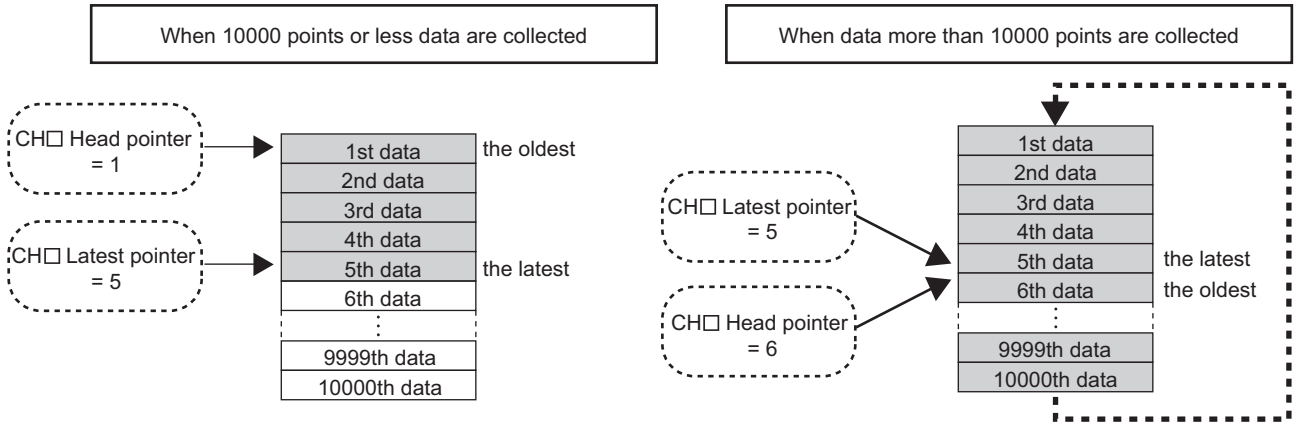
Point

When the logging cycle determined by CH□ Logging cycle setting value (Un\G1032 to Un\G1035) and CH□ Logging cycle unit setting (Un\G1040 to Un\G1043) is shorter than the conversion cycle, an error occurs and logging does not start. Error code (202□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on.

(6) Head pointer and latest pointer

The storage location of the latest data and the oldest data in the logging data storage area can be checked with the following buffer memory areas.

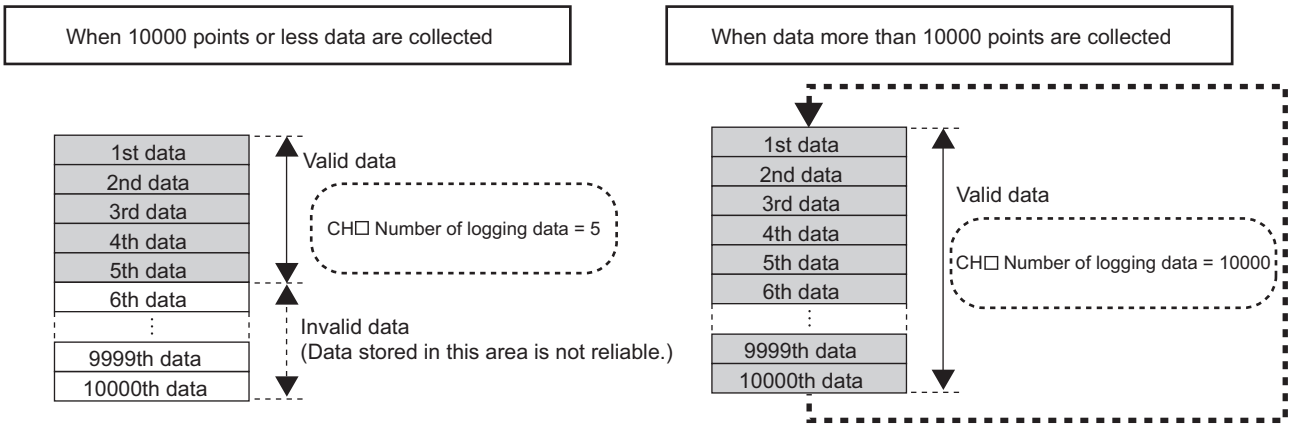
Buffer memory	Description
CH☐ Head pointer (Un\G1090 to Un\G1093)	Stores a number indicating the address where the oldest data is stored in the logging data storage area for each channel. The number is a count from the start address.
CH☐ Latest pointer (Un\G1098 to Un\G1101)	Stores a number indicating the address where the latest data is stored in the logging data storage area for each channel. The number is a count from the start address.



CH☐ Head pointer (Un\G1090 to Un\G1093) does not change until all the addresses of the logging data storage area are used after logging starts (The value is fixed to 0). When all the addresses are filled, the next data is stored in the first address of the logging data storage area. When the existing data is overwritten, the value of CH☐ Head pointer (Un\G1090 to Un\G1093) increases by one.

(7) Number of logging data

The number of valid logging data in the logging data storage area can be checked with CH☐ Number of logging data (Un\G1106 to Un\G1109).



The number of logging data in CH☐ Number of logging data (Un\G1106 to Un\G1109) increases by one every time a new point is stored.

When all the addresses of the logging data storage area are filled, the next data is stored in the first address of the logging data storage area. The logging operation continues overwriting the existing data.

(8) Checking logging data without stopping the logging operation

Logging data can be checked during logging operation with CH□ Head pointer (Un\G1090 to Un\G1093), CH□ Latest pointer (Un\G1098 to Un\G1101), and CH□ Number of logging data (Un\G1106 to Un\G1109).
To check logging data, adjust the logging cycle to prevent the logging data from being refreshed while the data is read out.
In addition, check the following precautions.

- Set CH□ Logging cycle setting value (Un\G1032 to Un\G1035) to the cycle that data checking and reading surely complete before logging data is refreshed. If the logging cycle is short, logging data may be refreshed while checking and reading data.
- After obtaining the logging data which need to be checked, monitor the variation of CH□ Head pointer (Un\G1090 to Un\G1093) and CH□ Number of logging data (Un\G1106 to Un\G1109). Obtain logging data after the stored value changes.
- If the data refresh and the data being checked do not synchronize due to the relationship between the logging cycle and the scan time of the CPU module, adjust the logging cycle.
- To check the data without paying attention to logging cycle, use Logging hold request. (☞Page 148, Section 8.13.2)

8.13.1 Logging load detection function

With the logging load detection function, more than 10000 points of data can be stored by transferring the device data stored in the buffer memory of the A/D converter module to the file registers of the CPU module without stopping logging. The takt time of a test which requires high-speed conversion can be shortened.

The data transferred to the file registers of the CPU module can be saved using the latch function.

- MELSEC-L CPU Module User's Manual (Function Explanation, Program Fundamentals)

(1) Overview of the logging load detection function

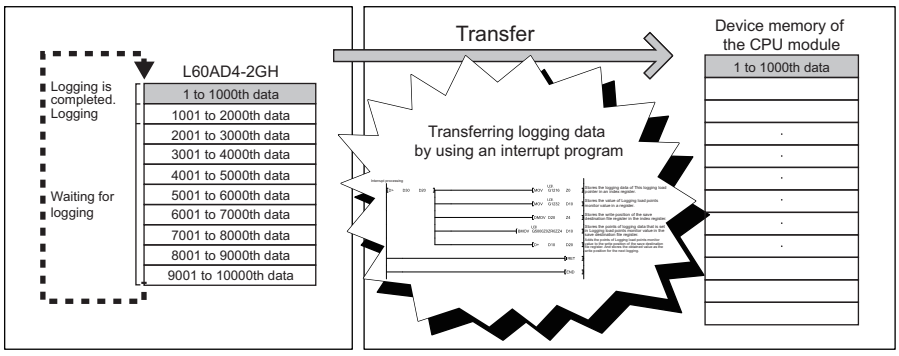
After logging starts, an interrupt request is sent to the CPU module and an interrupt program is executed every time the preset number of data to be read is logged.

The A/D converter module has four points of the interrupt cause (SI) corresponding to the logging load detection of each channel.

For the setting of interrupt pointers, refer to the following.

- Setting of interrupt pointers (Page 143, Section 8.13.1 (6) (b))

Ex. When 1000 points of the latest logging data are transferred to the device memory of the CPU module every time 1000 points of data are logged



(2) Setting of interrupt pointers

Assign the interrupt causes (SI) of the A/D converter module and interrupt pointers of the CPU module with the intelligent function module interrupt pointer setting of the programming tool.

- Set a start number of the interrupt pointers used for "Interrupt Pointer Start No.".
- Set "Interrupt Pointer Count" to a maximum number of the channels where this function is enabled.

The following table lists the interrupt causes of the logging load pointer detection.

SI No.	Interrupt cause
0	CH1 Logging load pointer detection
1	CH2 Logging load pointer detection
2	CH3 Logging load pointer detection
3	CH4 Logging load pointer detection

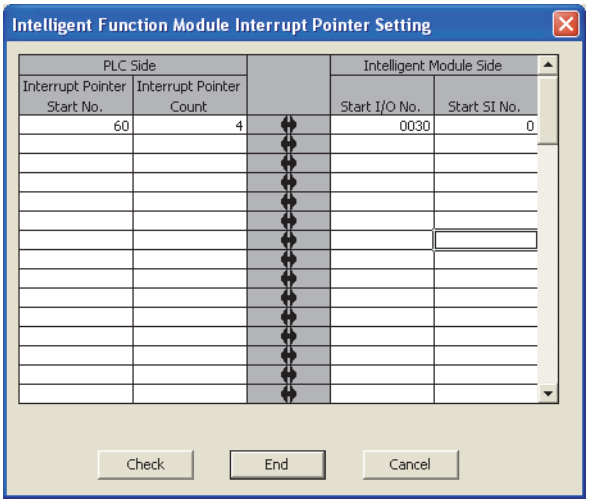
Point

Interrupt causes used must be assigned to the interrupt pointers of the CPU module. If the causes are not assigned, an error may occur on the CPU module side.

1. Set the interrupt pointers of the CPU module to SI No. 0 to No. 3.

Ex. When the logging load pointer detection interrupts (SI0 to SI3) are assigned to the interrupt pointers (I60 and later) of the CPU module

Project window ⇨ [Parameter] ⇨ [PLC Parameter] ⇨ [PLC System] ⇨ Interrupt Pointer Setting button



Point

To use only specific SI No., choose one of the following methods.

- Using "Intelligent function module interrupt pointer setting" in the PLC parameter
  The same number of interrupt causes as that of pointers counted from the head SI No. is used with "Intelligent function module interrupt pointer setting".
  For example, when the head SI No. is set to 1 and the pointer count is set to 2, only SI1 and SI2 are used.
- Using IMASK instruction of the program
  With the IMASK instruction, setting whether to enable or disable (interrupt-mask) the interrupt program for each interrupt pointer number is possible.
- For details on the interrupt programs, refer to the following.

  MELSEC-L CPU Module User's Manual (Function Explanation, Program Fundamentals)

(3) Starting logging load detection function

To use this function, Set CH☐ Loading interrupt enable/disable setting (Un\G1200 to Un\G1203) to Enabled (0) and set CH☐ Logging load points setting value (Un\G1208 to Un\G1211) to the number of logging points that causes the interrupt. This function starts when Operating condition setting request (Y9) is turned on then off.

(a) This logging load pointer

Set a value whose integral multiple becomes 10000 in CH☐ Logging load points setting value (Un\G1208 to Un\G1211). The setting range is between 10 and 10000.

When a value whose integral multiple does not become 10000 is set in CH☐ Logging load points setting value (Un\G1208 to Un\G1211), the number of the actual logging load points is forced to become a maximum value whose integral multiple is 10000 within the set value. The value of the number of logging load points is stored in CH☐ Logging load points monitor value (Un\G1232 to Un\G1235).

The number of logging load points		Logging load points monitor value
100	→	100
90	→	80
110	→	100
650	→	625
4000	→	2500

(4) Data checking method

(a) This logging load pointer

- The head pointer read from CH☐ Logging data (Un\G5000 to Un\G44999) with the interrupt processing is stored in CH☐ This logging load pointer (Un\G1216 to Un\G1219).
- The default value of CH☐ This logging load pointer (Un\G1216 to Un\G1219) is -1.
- The value stored in CH☐ This logging load pointer (Un\G1216 to Un\G1219) is calculated by the following formula and stored every time the same number of data as the value stored in CH☐ Logging load points monitor value (Un\G1232 to Un\G1235) is logged.

This logging load pointer = Latest pointer[*1] - Logging load points monitor value + 1

*1 Indicates the address where the latest data is stored in the logging data storage area.

(b) Last logging load pointer

- This logging load pointer of when the previous pointer detection interrupt occurs is stored in CH☐ Last logging load pointer (Un\G1224 to Un\G1227).
- The default value of CH☐ Last logging load pointer (Un\G1224 to Un\G1227) is -1.
- CH☐ Last logging load pointer (Un\G1224 to Un\G1227) is used to detect the overlap of the detection interrupt processing of the logging load pointer. (☞Page 143, Section 8.13 (7))

Ex. The values stored in each pointer at every detection interrupt of the load pointer when the logging load detection starts with CH☐ Logging load points setting value (Un\G1208 to Un\G1211) being set to 1000.

Relative address	Buffer memory
0	1st data
⋮	⋮
999	1000th data
1000	1001st data
⋮	⋮
1999	2000th data
2000	2001st data
⋮	⋮
9999	10000th data

←

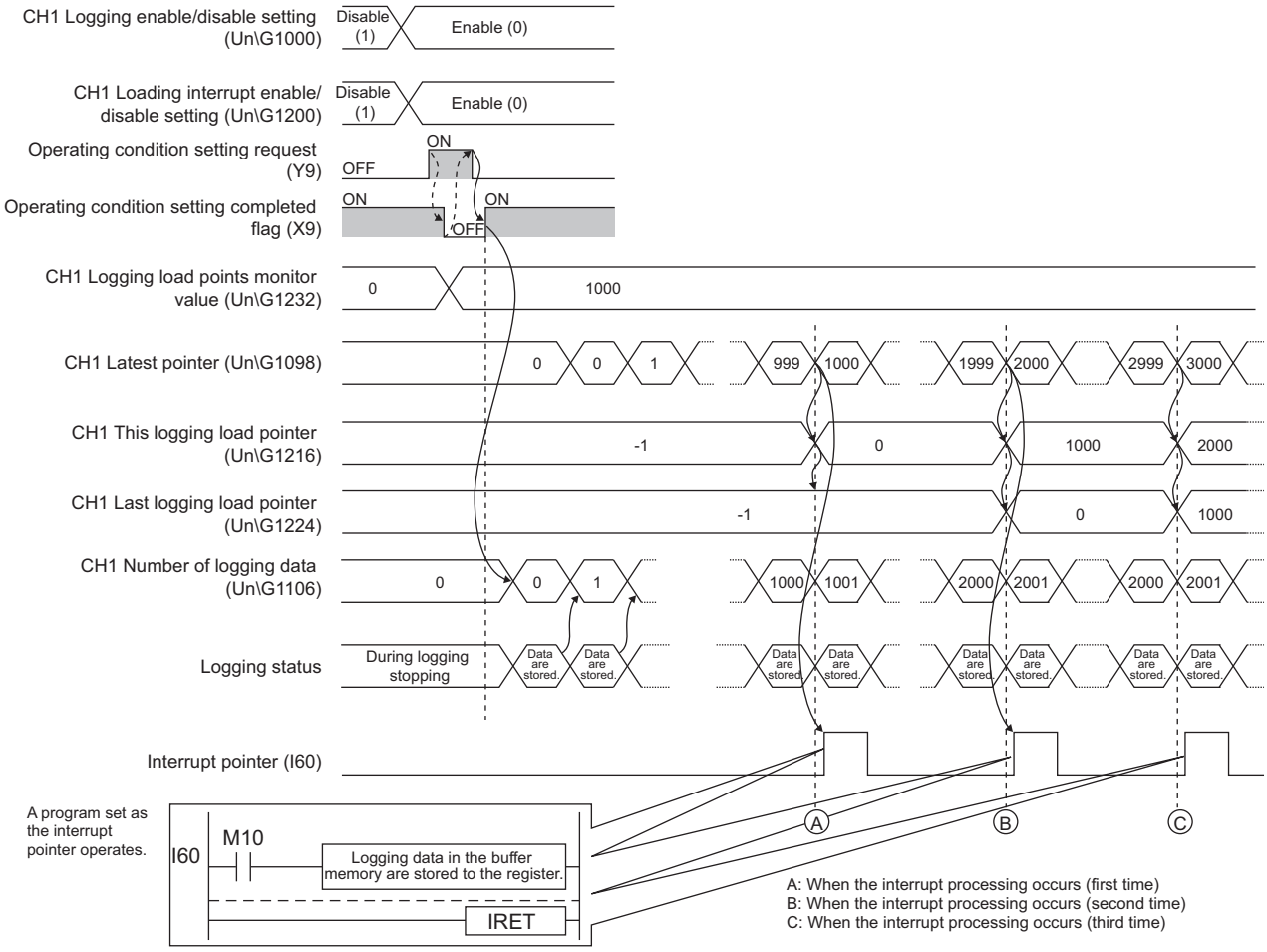
Load pointer detection interrupt	Last logging load pointer	This logging load pointer	Latest pointer
Initial value	-1	-1	0
1st time	-1	0	999
2nd time	0	1000	1999
3rd time	1000	2000	2999
⋮	⋮	⋮	⋮
10th time	8000	9000	9999
11th time	9000	0	999
12th time	0	1000	1999

(5) Operation of the logging load detection function

This function starts by setting interrupt pointers and turning on then off Operating condition setting request (Y9). This function repeats its operation every time the same number of data as the logging load points monitor value is logged.

Ex. The following figure shows the operation when the logging load detection function is used under the following conditions.

- A/D conversion-enabled channel: 1CH
- Logging load points setting value: 1000 points
- Interrupt Pointer Start No.: 60
- Interrupt Pointer Count: 1



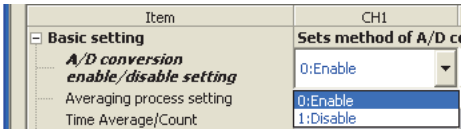
(6) Setting procedure

1. Setting of interrupt pointers

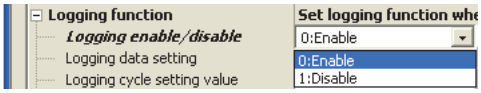
Assign the interrupt causes (SI) of the A/D converter module and interrupt pointers of the CPU module with the intelligent function module interrupt pointer setting of the programming tool. (Page 137, Section 8.13.1 (1))

2. Set "A/D conversion enable/disable setting" to "0: Enable".

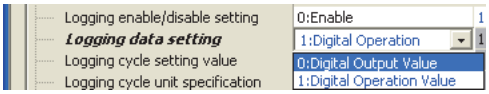
Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



3. Set "Logging enable/disable setting" to "0: Enable".



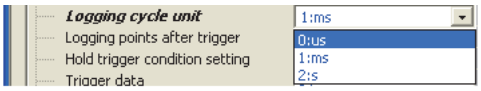
4. Set the target data in "Logging data setting".



5. Set the cycle of storing logging data to "Logging cycle setting value".



6. Select the unit of "Logging cycle setting value" in "Logging cycle unit specification".



7. Set "Loading interrupt enable/disable setting" to "0: Enable".



8. Set the number of logging points that cause a load interrupt in "Logging load points setting value".



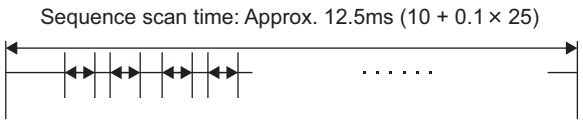
(7) Precautions for the use of the logging load detection function

To generate logging load pointer detection interrupts, set the logging load detection function and create an interrupt program under the following precautions.

- The sequence scan time becomes longer because of the processing time of the interrupt program set to interrupt pointers. When the logging load detection function is used, consider the interrupt program set to interrupt pointers.

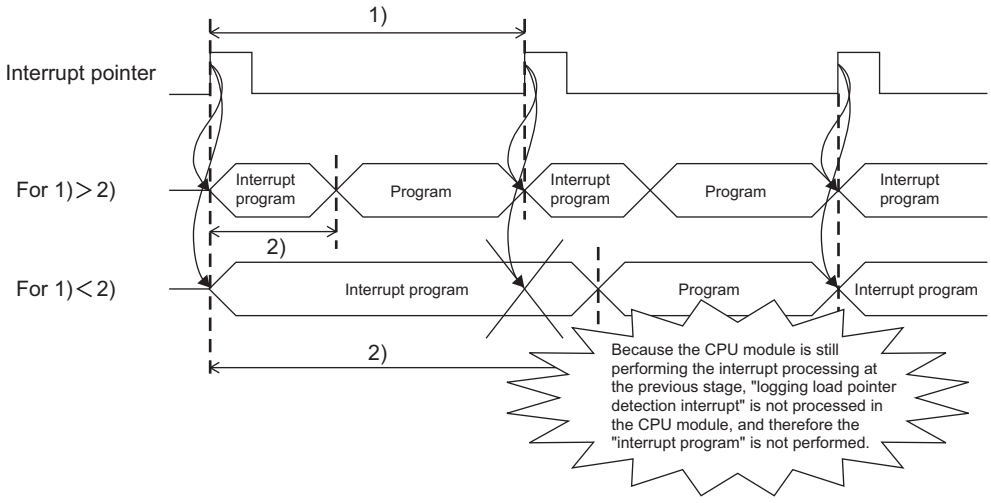
Ex. When the following are set in the program with the sequence scan time of 10ms
Logging cycle: 40μs
Logging load points: 10
Processing time for the interrupt program: 100μs

When the logging load detection function is used
The interrupt program (100μs) is processed per 400μs.



- When the processing time of the interrupt program is longer than the interval of logging load pointer detection interrupts, the CPU module fails to capture the logging load pointer detection interrupts. To prevent it, set the processing time of the interrupt program to a shorter time than the interval of logging load pointer detection interrupts.

  When the CPU module fails to capture a logging load pointer detection interrupt, the interrupt program is not processed.
  The following figure and table show the interval of logging load pointer detection interrupts and the processing time of the interrupt ladder program.


1)
Interrupt pointer
For 1) > 2)
Interrupt program
Program
Interrupt program
Program
Interrupt program
2)
For 1) < 2)
Interrupt program
Program
Interrupt program
2)
Because the CPU module is still performing the interrupt processing at the previous stage, "logging load pointer detection interrupt" is not processed in the CPU module, and therefore the "interrupt program" is not performed.

No.	Item	Description
1)	Interval of logging load pointer detection interrupts	Logging points × Logging cycle (Page 143, Section 8.13.1 (6) (b))
2)	Processing time of the interrupt program	The total time of the overhead time before startup and at termination of the interrupt program in the CPU module and the scan time of the interrupt program MELSEC-L CPU Module User's Manual (Function Explanation, Program Fundamentals)

(8) Example of use of the logging load detection function

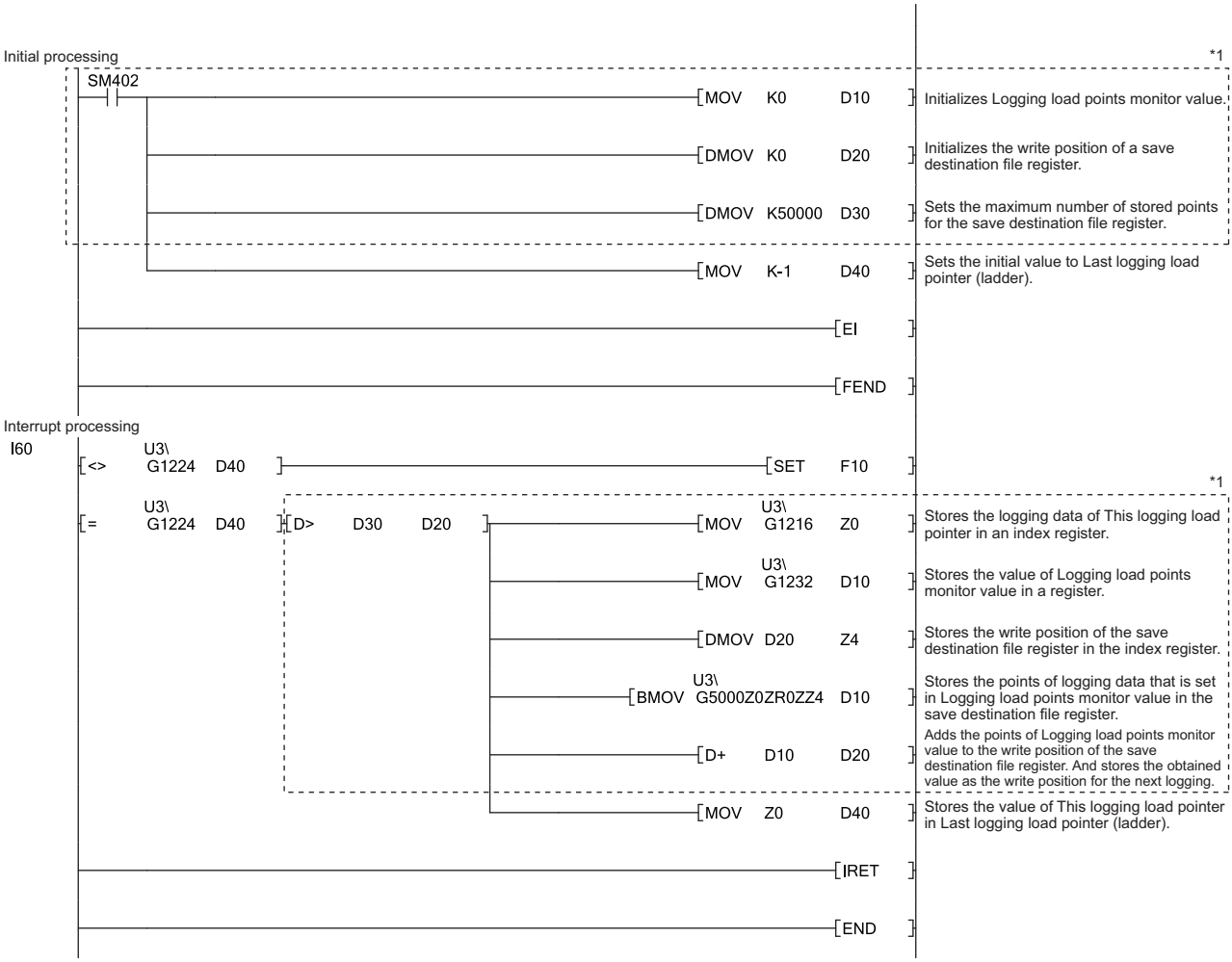
The following describes the program example of use of the logging load detection function.

(a) A program example which detects a logging load pointer detection interrupt being not captured

- This program stores a this logging load pointer (to Device A) as a last logging load pointer.
- When a last logging load pointer is not equal to the value in Device A at the start of the next interrupt program, the logging load pointer detection interrupt is judged that it is not captured.

Ex. When the logging data are stored every 1000 points to the data registers of the CPU module under the following conditions

- CPU module: L26CPU-BT
- CH1 Logging load points setting value (Un\G1208): 1000
- Interrupt Pointer Start No.: 60
- Interrupt Pointer Count: 1


Initial processing
*1
SM402
MOV K0 D10
Initializes Logging load points monitor value.
DMOV K0 D20
Initializes the write position of a save destination file register.
DMOV K50000 D30
Sets the maximum number of stored points for the save destination file register.
MOV K-1 D40
Sets the initial value to Last logging load pointer (ladder).
EI
FEND
Interrupt processing
I60
U3\G1224 <> D40
SET F10
*1
U3\G1224 = D40
D> D30 D20
MOV U3\G1216 Z0
Stores the logging data of This logging load pointer in an index register.
MOV U3\G1232 D10
Stores the value of Logging load points monitor value in a register.
DMOV D20 Z4
Stores the write position of the save destination file register in the index register.
BMOV U3\G5000Z0ZR0ZZ4 D10
Stores the points of logging data that is set in Logging load points monitor value in the save destination file register.
D+ D10 D20
Adds the points of Logging load points monitor value to the write position of the save destination file register. And stores the obtained value as the write position for the next logging.
MOV Z0 D40
Stores the value of This logging load pointer in Last logging load pointer (ladder).
IRET
END

*1 The program in the dotted line is a common program.

Device	Description
D10	Logging load points monitor value
D20	The write position of the save destination file register
D30	Maximum number of stored points of the save destination file register
Z0	Index register for logging load position
Z4	Index register for the save destination file register
ZR0	Save destination file register
D40	Last logging load pointer (ladder)

This program finishes the interrupt processing by turning on the annunciator when the interrupt being not captured is detected.

This program takes the following time at a maximum to process the logging load pointer detection interrupt.

Item	Processing time	
	L02CPU, L02CPU-P	L26CPU-BT, L26CPU-PBT
Overhead time before startup of the interrupt program	66.0μs	61.0μs
Overhead time at termination of the interrupt program	28.0μs	26.0μs
Sequence scan time of the interrupt ladder program	460.0μs	
Total processing time of the interrupt program	554μs	547μs

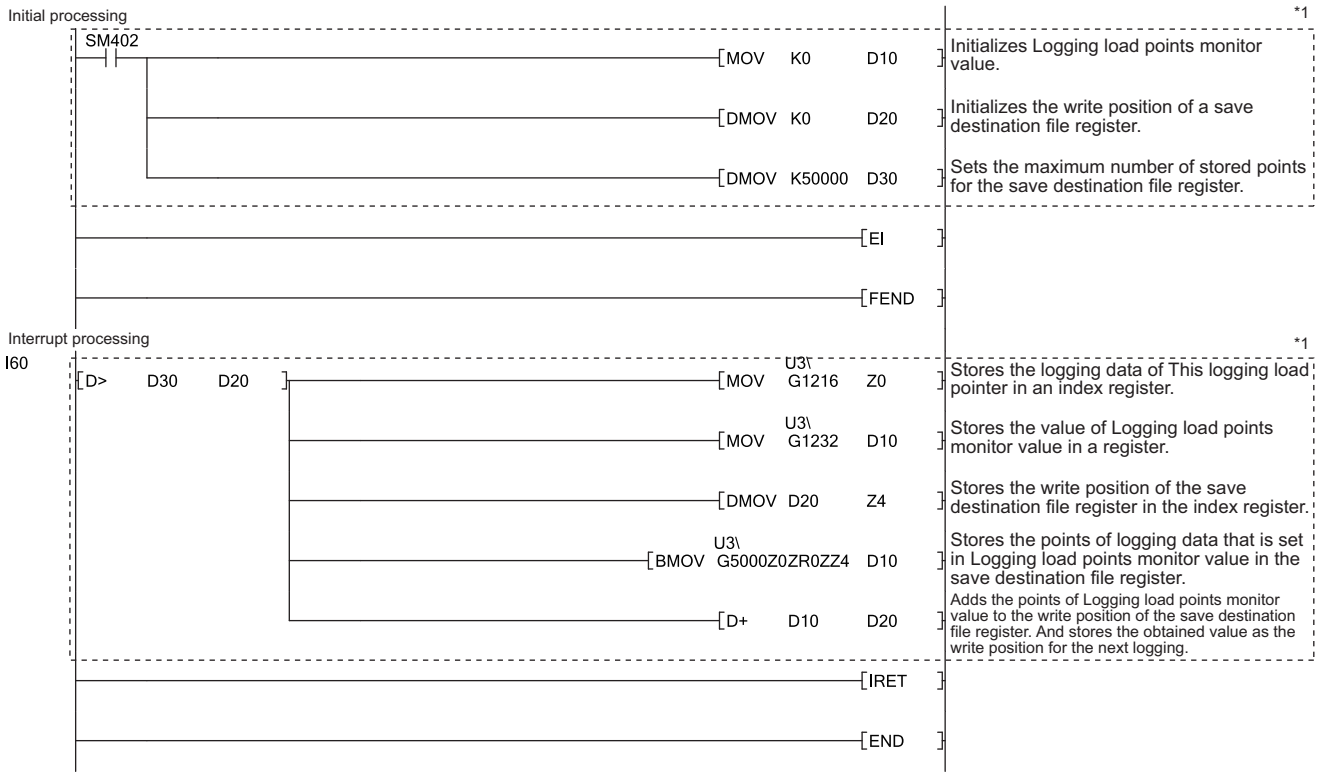
Point

Set CH□ Logging cycle setting value (Un\G1032 to Un\G1035) and CH□ Logging load points setting value (Un\G1208 to Un\G1211) so that the interval of a logging load pointer detection interrupt is longer than the total processing time of the interrupt program.

(b) A program example which does not detect a logging load pointer detection interrupt being not captured

Ex. When the logging data are stored every 1000 points to the data registers of the CPU module under the following conditions

- CPU module: L26CPU-BT
- CH1 Logging load points setting value (Un\G1208): 1000
- Interrupt Pointer Start No.: 60
- Interrupt Pointer Count: 1


Initial processing
*1
SM402
MOV K0 D10
Initializes Logging load points monitor value.
DMOV K0 D20
Initializes the write position of a save destination file register.
DMOV K50000 D30
Sets the maximum number of stored points for the save destination file register.
EI
FEND
Interrupt processing
I60
*1
D> D30 D20
MOV U3\G1216 Z0
Stores the logging data of This logging load pointer in an index register.
MOV U3\G1232 D10
Stores the value of Logging load points monitor value in a register.
DMOV D20 Z4
Stores the write position of the save destination file register in the index register.
BMOV U3\G5000Z0ZR0ZZ4 D10
Stores the points of logging data that is set in Logging load points monitor value in the save destination file register.
D+ D10 D20
Adds the points of Logging load points monitor value to the write position of the save destination file register. And stores the obtained value as the write position for the next logging.
IRET
END

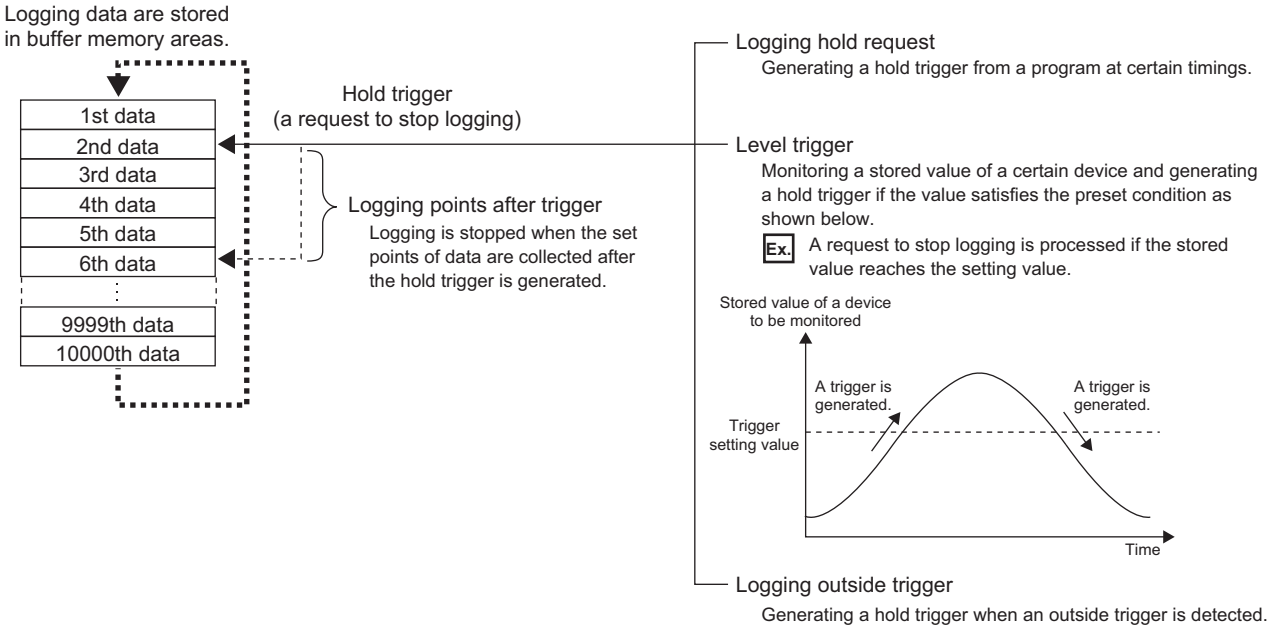
Device	Description
D10	Logging load points monitor value
D20	The write position of the save destination file register
D30	Maximum number of stored points of the save destination file register
Z0	Index register for logging load position
Z4	Index register for the save destination file register
ZR0	Save destination file register

8.13.2 Stopping the logging operation

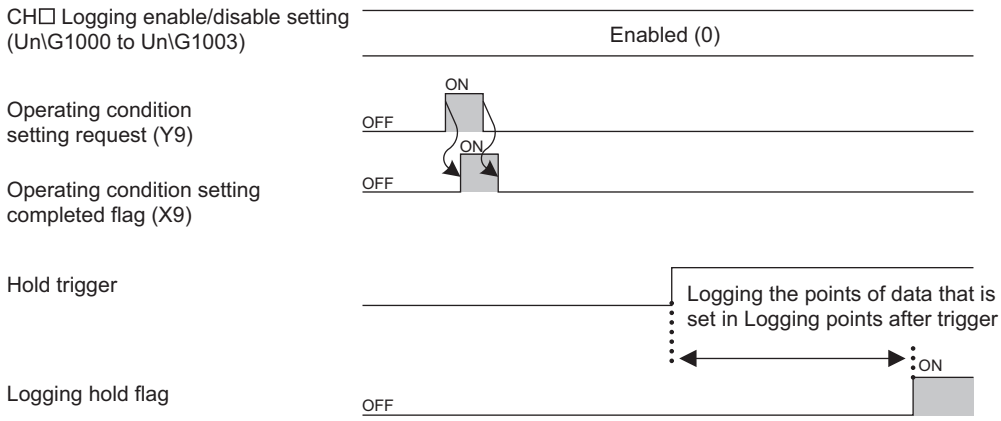
Logging operation stops when the preset trigger condition is satisfied and the set points of the data are collected.

The trigger which stops logging when the trigger condition is satisfied is called "hold trigger (a request to stop logging)". The method of causing a hold trigger (a request to stop logging) can be chosen from the following. Combination is not available.

- Logging hold request (☞Page 152, Section 8.13.3)
- Level trigger (☞Page 154, Section 8.13.4)
- Logging outside trigger (☞Page 157, Section 8.13.5)


Logging data are stored in buffer memory areas.
1st data
2nd data
3rd data
4th data
5th data
6th data
9999th data
10000th data
Hold trigger (a request to stop logging)
Logging points after trigger
Logging is stopped when the set points of data are collected after the hold trigger is generated.
Logging hold request
Generating a hold trigger from a program at certain timings.
Level trigger
Monitoring a stored value of a certain device and generating a hold trigger if the value satisfies the preset condition as shown below.
Ex. A request to stop logging is processed if the stored value reaches the setting value.
Stored value of a device to be monitored
A trigger is generated.
A trigger is generated.
Trigger setting value
Time
Logging outside trigger
Generating a hold trigger when an outside trigger is detected.

When a hold trigger (a request to stop logging) is detected during logging operation, the operation stops after the points of the data specified with CH☐ Logging points after trigger (Un\G1048 to Un\G1051) are logged.



(1) Logging points after trigger

Set CH☐ Logging points after trigger (Un\G1048 to Un\G1051) to the number of data collected in the period from the detection of a hold trigger (a request to stop logging) to logging operation stop.

(2) Check on logging stop

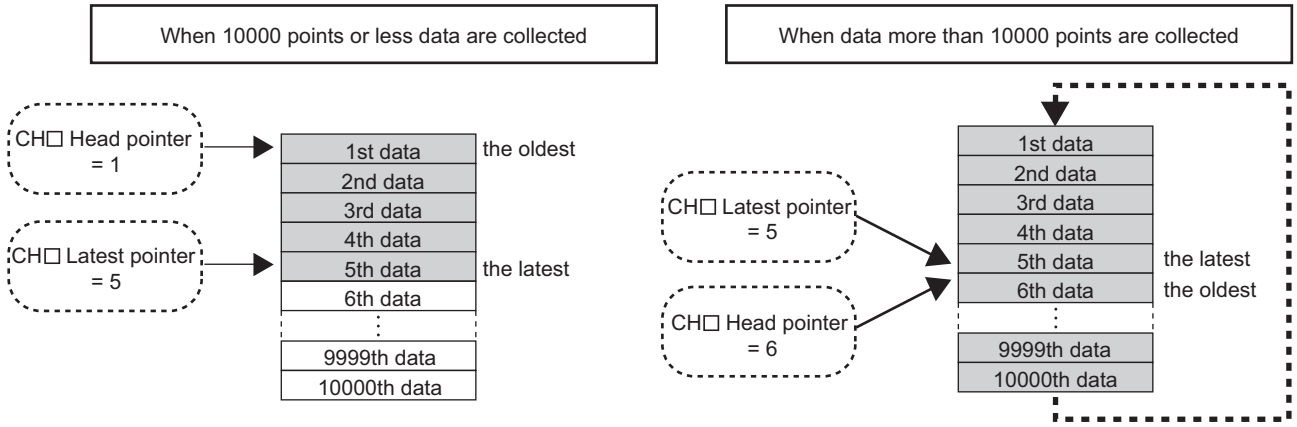
Check that CH☐ Logging hold flag (Un\G1016 to Un\G1019) is ON (1).

(3) Checking logging data

(a) Head pointer and latest pointer

The storage location of the latest data and the oldest data in the logging data storage area can be checked with the following buffer memory areas.

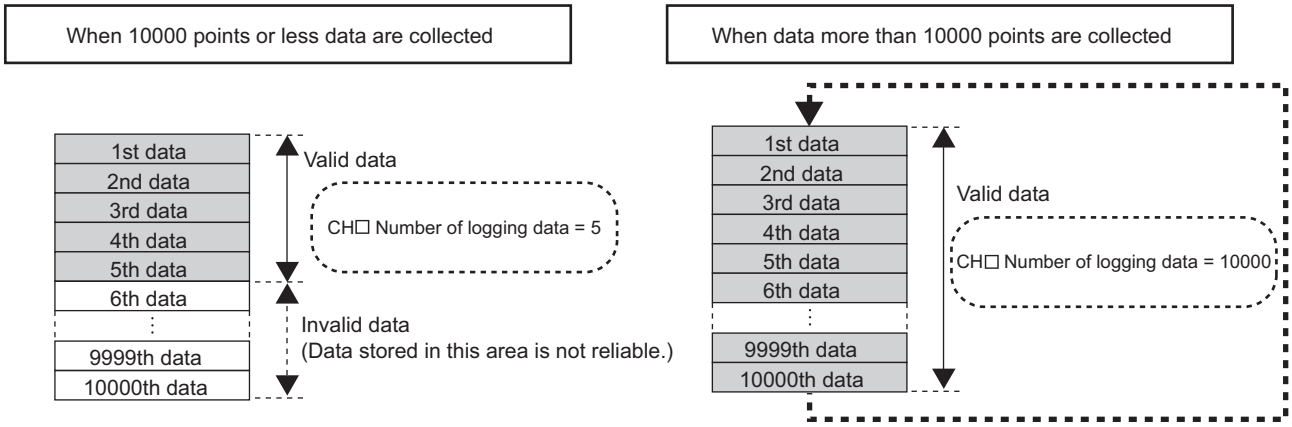
Buffer memory	Description
CH☐ Head pointer (Un\G1090 to Un\G1093)	Stores a number indicating the address where the oldest data is stored in the logging data storage area for each channel. The number is a count from the start address.
CH☐ Latest pointer (Un\G1098 to Un\G1101)	Stores a number indicating the address where the latest data is stored in the logging data storage area for each channel. The number is a count from the start address.



CH☐ Head pointer (Un\G1090 to Un\G1093) does not change until all the addresses of the logging data storage area are used after logging starts (The value is fixed to 0). When all the addresses are filled, the next data is stored in the first address of the logging data storage area. When the existing data is overwritten, the value of CH☐ Head pointer (Un\G1090 to Un\G1093) increases by one.

(b) The number of logging data

The number of valid logging data in the logging data storage area can be checked with CH☐ Number of logging data (Un\G1106 to Un\G1109).



The value of CH☐ Number of logging data (Un\G1106 to Un\G1109) increases by one every time a new data is stored.

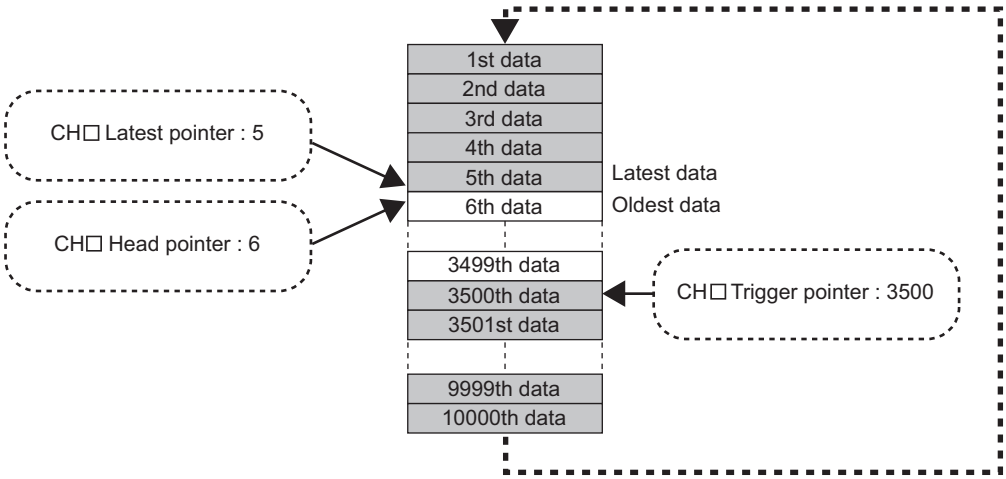
When all the addresses of the logging data storage area are filled, the next data is stored in the first address of the logging data storage area. The logging operation continues overwriting the existing data.

(c) Checking data when a hold trigger (a request to stop logging) occurs

The storage location of the data when a hold trigger (a request to stop logging) occurs can be checked with CH☐ Trigger pointer (Un\G1114 to Un\G1117).

Ex. The value stored in CH☐ Trigger pointer (Un\G1114 to Un\G1117) when the logging operation stops under the following conditions

- CH☐ Logging points after trigger (Un\G1048 to Un\G1051): 6505 points
- The data that causes a hold trigger (a request to stop logging): 3500th data.



(d) Checking trigger detection time

The trigger detection time can be checked with CH□ Trigger detection time (Un\G1154 to Un\G1169).
Even when the logging cycle is set to a period less than 1s, the minimum time unit recorded in CH□ Trigger detection time (Un\G1154 to Un\G1169) is second. Use trigger detection time as an indication to refer to the logging data.

Ex. When CH1 Trigger detection time (Un\G1154 to Un\G1157) is monitored

	b15 to b8	b7 to b0
Un\G1154	First two digits of the year	Last two digits of the year
Un\G1155	Month	Day
Un\G1156	Hour	Minute
Un\G1157	Second	Day of the week

- First two digits of the year, last two digits of the year, month, day, hour, minute, and second are all stored in the BCD code.
- In "Day of the week" segment, one of the following values in the BCD code indicating the corresponding day is stored.

Sunday:	Monday:	Tuesday:	Wednesday:	Thursday:	Friday:	Saturday:
00_H	01_H	02_H	03_H	04_H	05_H	06_H

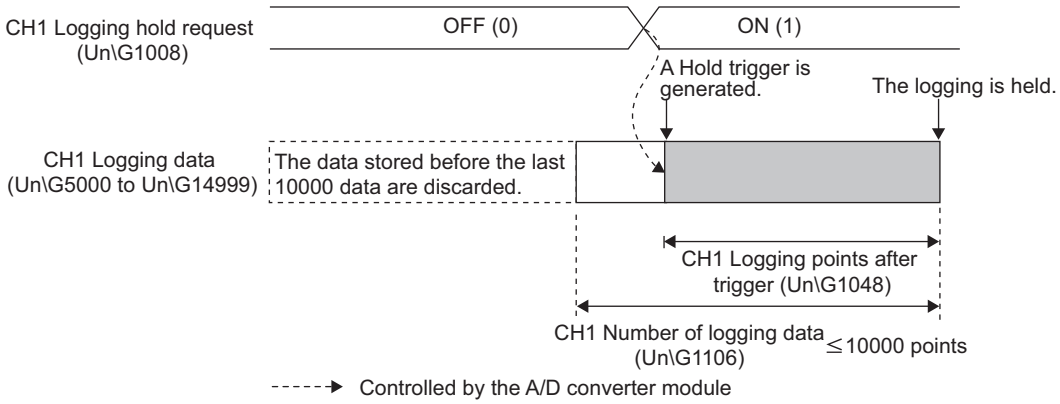
Point

The trigger detection time is obtained from the clock data of the CPU module. Therefore, when a hold trigger (a request to stop logging) is caused right after the programmable controller is powered on, the A/D converter module may not obtain the clock data from the CPU module. If the module could not obtain the time, the trigger detection time is recorded as "0:0:0 on January 1st, 2000".

8.13.3 Logging hold request

A hold trigger (a request to stop logging) is generated from a program at any timing.

Logging starts when CH□ Logging hold request (Un\G1008 to Un\G1011) is set to ON (1) and stops after a preset number of the data is logged.


CH1 Logging hold request (Un\G1008)
OFF (0)
ON (1)
A Hold trigger is generated.
The logging is held.
CH1 Logging data (Un\G5000 to Un\G14999)
The data stored before the last 10000 data are discarded.
CH1 Logging points after trigger (Un\G1048)
CH1 Number of logging data (Un\G1106)
≤10000 points
Controlled by the A/D converter module

Point

- When Operating condition setting request (Y9) is turned on during logging, the logging stops regardless of the ON/OFF status of a hold trigger (a request to stop logging). All the logging data that have been stored before CH□ Operating condition setting request (Y9) is turned on are cleared.
- Check that CH□ Logging hold flag (Un\G1016 to Un\G1019) is ON (1), and set CH□ Logging hold request (Un\G1008 to Un\G1011) to OFF (0). When CH□ Logging hold request (Un\G1008 to Un\G1011) is set to OFF (0) before the logging stops, the logging does not stop.
- The following delay occurs at a maximum until the A/D converter module receives a hold trigger (a request to stop logging) after CH□ Logging hold request (Un\G1008 to Un\G1011) is set to ON (1).
  Trigger delay = Logging cycle (Cycle at which logging is actually performed) + Scan time of the CPU module

(1) Check on logging stop

Check that CH□ Logging hold flag (Un\G1016 to Un\G1019) is ON (1).

(2) Checking logging data

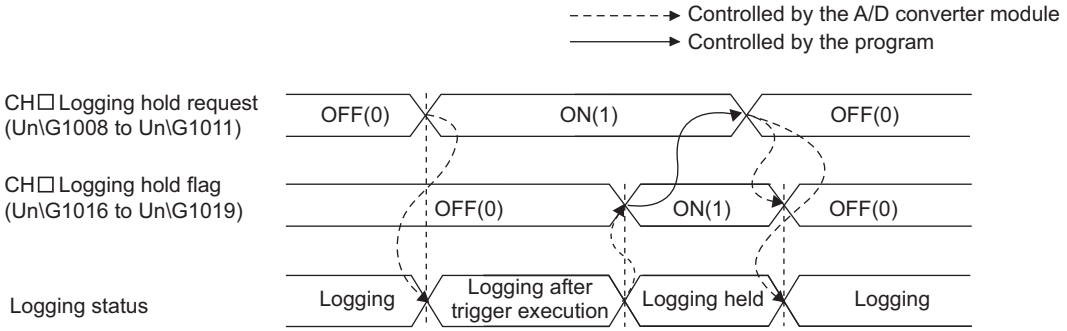
Refer to the following.

☞Page 149, Section 8.13.2 (3)

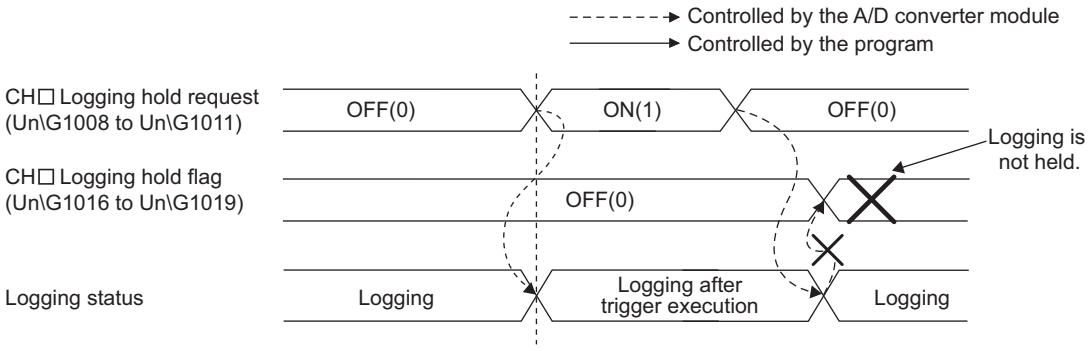
(3) Resuming logging

To resume logging, set CH☐ Logging hold request (Un\G1008 to Un\G1011) to OFF (0). After logging resumes, the value is stored from the head buffer memory area of the logging data storage area.
In addition, OFF (0) is stored in CH☐ Logging hold flag (Un\G1016 to Un\G1019).

It may take time until ON (1) is stored in CH☐ Logging hold flag (Un\G1016 to Un\G1019) after CH☐ Logging hold request (Un\G1008 to Un\G1011) is set to ON (1). To resume logging, check that ON (1) is stored in CH☐ Logging hold flag (Un\G1016 to Un\G1019) and set CH☐ Logging hold request (Un\G1008 to Un\G1011) to OFF (0).



- Logging does not stop when OFF (0) is set to CH☐ Logging hold request (Un\G1008 to Un\G1011) before ON (1) is stored in CH☐ Logging hold flag (Un\G1016 to Un\G1019).



(a) Buffer memory status when logging resumes

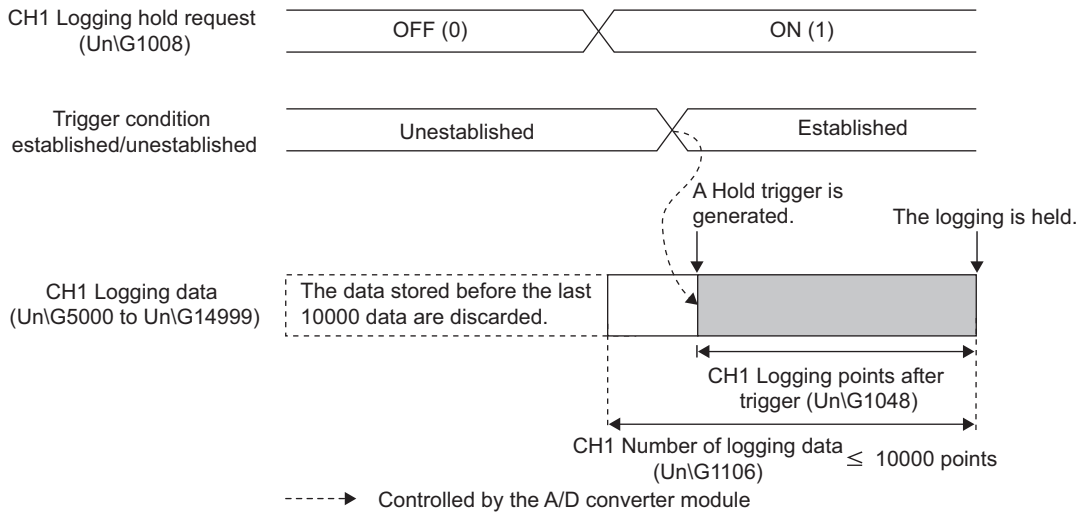
The following table shows the buffer memory status when logging resumes.

Buffer memory	Value status
CH☐ Head pointer (Un\G1090 to Un\G1093)	Values are initialized (default value: 0).
CH☐ Latest pointer (Un\G1098 to Un\G1101)	
CH☐ Number of logging data (Un\G1106 to Un\G1109)	
CH☐ Trigger pointer (Un\G1114 to Un\G1117)	
CH☐ Logging data (Un\G5000 to Un\G44999)	• The values before logging resumes are not initialized. • After logging resumes, collected data is stored from the head buffer memory area of the logging data storage area. To refer to the logging data, check which area has valid data with CH☐ Number of logging data (Un\G1106 to Un\G1109).

8.13.4 Level trigger

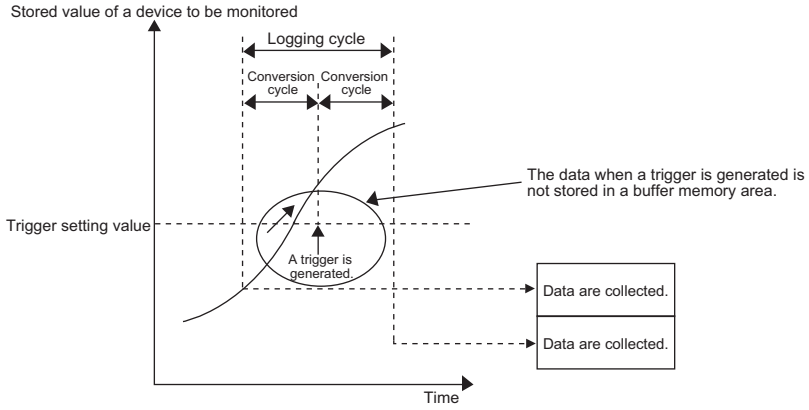
When a target value in the buffer memory monitored satisfies a preset condition, a hold trigger (a request to stop logging) is generated.
The target data of a level trigger is monitored on the refresh cycle of the digital output value and the digital operation value.

To use a level trigger, CH□ Logging hold request (Un\G1008 to Un\G1011) must be set to ON (1) in advance. When CH□ Logging hold request (Un\G1008 to Un\G1011) is set to ON (1), the trigger condition waits for itself being satisfied. The logging hold processing starts when the trigger condition is satisfied.


CH1 Logging hold request (Un\G1008)
OFF (0)
ON (1)
Trigger condition established/unestablished
Unestablished
Established
A Hold trigger is generated.
The logging is held.
CH1 Logging data (Un\G5000 to Un\G14999)
The data stored before the last 10000 data are discarded.
CH1 Logging points after trigger (Un\G1048)
CH1 Number of logging data (Un\G1106)
≤ 10000 points
Controlled by the A/D converter module

Point

- When Operating condition setting request (Y9) is turned on during logging, the logging stops regardless of the ON/OFF status of a hold trigger (a request to stop logging). All the logging data that have been stored before CH□ Operating condition setting request (Y9) is turned on are cleared.
- Check that CH□ Logging hold flag (Un\G1016 to Un\G1019) is ON (1) and set CH□ Logging hold request (Un\G1008 to Un\G1011) to OFF (0). When CH□ Logging hold request (Un\G1008 to Un\G1011) is set to OFF (0) before the logging stops, the logging does not stop.
- A level trigger is detected on the conversion cycle of the digital output value or the digital operation value. Therefore, the data when a hold trigger (a request to stop logging) is generated may not be stored in CH□ Logging data (Un\G5000 to Un\G44999) depending on the setting of the logging cycle.
- To store the data when a hold trigger (a request to stop logging) is generated in CH□ Logging data (Un\G5000 to Un\G44999), arrange related settings so that the conversion cycle of the target value (a trigger data) and the logging cycle (actual logging cycle) have the same time period.

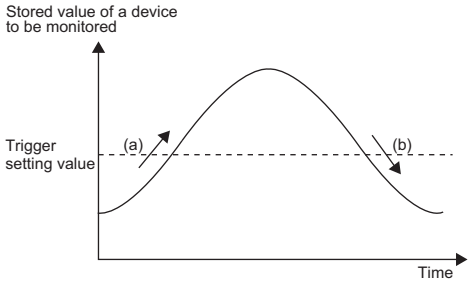

Stored value of a device to be monitored
Logging cycle
Conversion cycle
Conversion cycle
The data when a trigger is generated is not stored in a buffer memory area.
Trigger setting value
A trigger is generated.
Data are collected.
Data are collected.
Time

(1) Condition setting

Select one of the following three conditions that generate a hold trigger (a request to stop logging).
For the setting method of a hold trigger (a request to stop logging), refer to the following.

- Setting method of a hold trigger (a request to stop logging) (☞Page 159, Section 8.13.6)

(a) The condition setting of a level trigger

Setting value	Description	
Above (1)		Logging stops under the condition (a).
Below (2)		Logging stops under the condition (b).
Pass through (3)	(a) A hold trigger (a request to stop logging) is generated when the relation between the values changes from "Stored value of a device to be monitored ≤ Trigger setting value" to "Stored value of a device to be monitored > Trigger setting value". (b) A hold trigger (a request to stop logging) is generated when the relation between the values changes from "Stored value of a device to be monitored ≥ Trigger setting value" to "Stored value of a device to be monitored < Trigger setting value".	Logging stops under the condition (a) or (b).

(b) Trigger data

Set the address of the buffer memory monitored.

Item	Setting range
CH☐ Trigger data (Un\G1064 to Un\G1067)	0 to 4999

To monitor a device value of a module other than the A/D converter module such as a device of the CPU module, set a value between 1072 and 1081.

Point

Specify an appropriate data such as CH☐ Digital output value (Un\G11 to Un\G14), CH☐ Digital operation value (Un\G54 to Un\G57), and Level data ☐ (Un\G1072 to Un\G1081) to CH☐ Trigger data (Un\G1064 to Un\G1067). When a setting area or a system area is specified, normal operation is not guaranteed.

(c) Level data ☐

When CH☐ Trigger data (Un\G1064 to Un\G1067) is set to a value between 1072 and 1081, transfer refreshed values of the monitored device to Level data ☐ (Un\G1072 to Un\G1081) one after another.

Item	Setting range
Level data ☐ (Un\G1072 to Un\G1081)	-32768 to 32767

(d) Trigger setting value

Set CH☐ Trigger setting value (Un\G1082 to Un\G1085) to a value which generates a level trigger.

Item	Setting range
CH☐ Trigger setting value (Un\G1082 to Un\G1085)	-32768 to 32767

(2) Check on logging stop

Check that CH☐ Logging hold flag (Un\G1016 to Un\G1019) is ON (1).

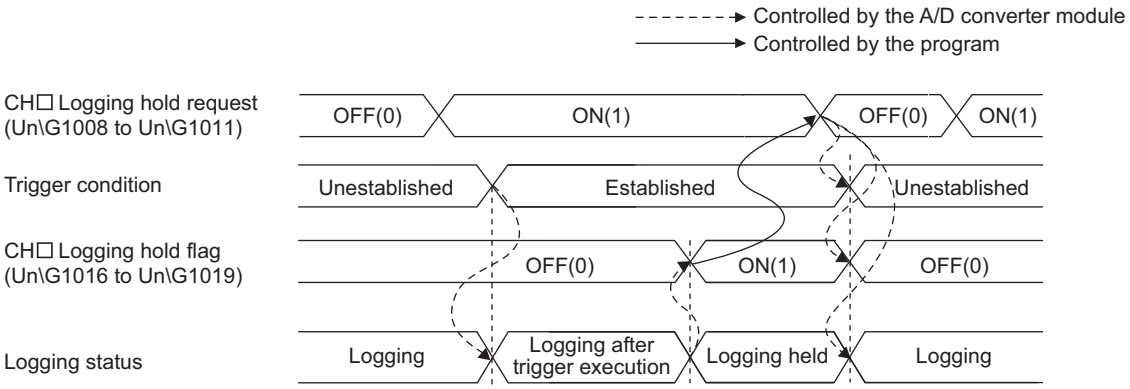
(3) Check on logging data

Refer to the following.

☞Page 149, Section 8.13.2 (3)

(4) Resuming logging

To resume the logging, set CH☐ Logging hold request (Un\G1008 to Un\G1011) to OFF (0). After logging resumes, collected data is stored from the head buffer memory area of the logging data storage area. In addition, OFF (0) is stored in CH☐ Logging hold flag (Un\G1016 to Un\G1019).



After logging resumes, set CH☐ Logging hold request (Un\G1008 to Un\G1011) to ON (1).

(a) Buffer memory status when logging resumes

Refer to the following.

☞Page 153, Section 8.13.3 (3) (a)

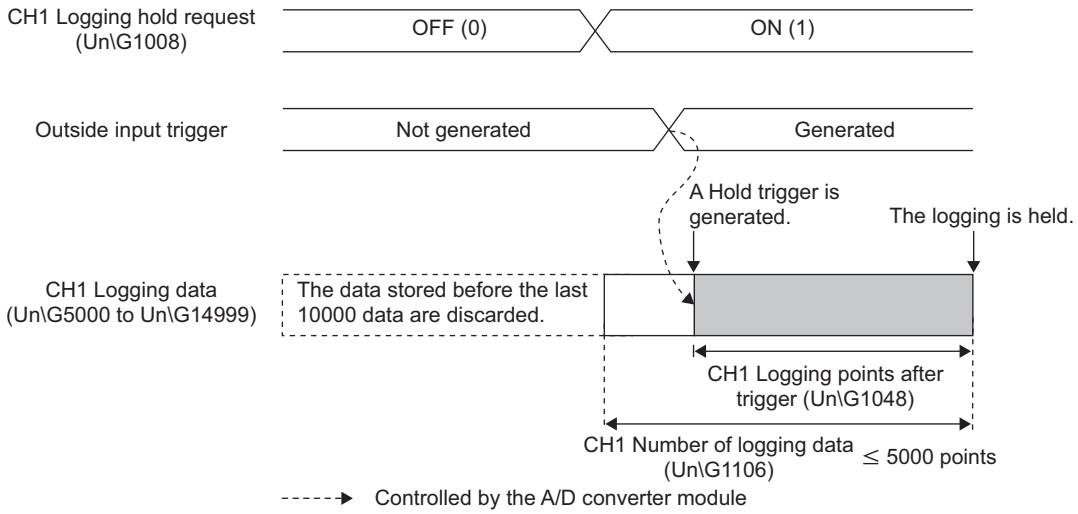
8.13.5 Logging outside trigger

A hold trigger (a request to stop logging) is generated when an outside trigger is detected.

To use a logging outside trigger, CH□ Logging hold request (Un\G1008 to Un\G1011) must be set to ON in advance. When CH□ Logging hold request (Un\G1008 to Un\G1011) is set to ON (1), the trigger condition waits for itself being satisfied. The logging stops when the specified number of data, started to be logged at the detection of the trigger, with CH□ Logging points after trigger (Un\G1048 to Un\G1051) is finished being collected.

Logging hold processing starts for all the channels where CH□ Hold trigger condition setting (Un\G1056 to Un\G1059) is set to Outside trigger (4).
For specification on the input voltage and current of the external input terminal, refer to the following.

- Performance Specifications (☞Page 26, Section 3.2)


CH1 Logging hold request (Un\G1008)
OFF (0)
ON (1)
Outside input trigger
Not generated
Generated
A Hold trigger is generated.
The logging is held.
CH1 Logging data (Un\G5000 to Un\G14999)
The data stored before the last 10000 data are discarded.
CH1 Logging points after trigger (Un\G1048)
CH1 Number of logging data (Un\G1106)
≤ 5000 points
Controlled by the A/D converter module

Point

- When Operating condition setting request (Y9) is turned on during logging, the logging stops regardless of the ON/OFF status of a hold trigger (a request to stop logging). All the logging data that have been stored before CH□ Operating condition setting request (Y9) is turned on are cleared.
- Check that CH□ Logging hold flag (Un\G1016 to Un\G1019) is ON (1) and set CH□ Logging hold request (Un\G1008 to Un\G1011) to OFF (0). When CH□ Logging hold request (Un\G1008 to Un\G1011) is set to OFF (0) before the logging stops, the logging does not stop.
- The following delay occurs at a maximum until the A/D converter module receives a hold trigger (a request to stop logging) after CH□ Logging hold request (Un\G1008 to Un\G1011) is set to ON (1).
  Trigger delay = Logging cycle (Cycle at which logging is actually performed) + Response time of an outside trigger

(1) Check on logging stop

Check that CH□ Logging hold flag (Un\G1016 to Un\G1019) is ON (1).

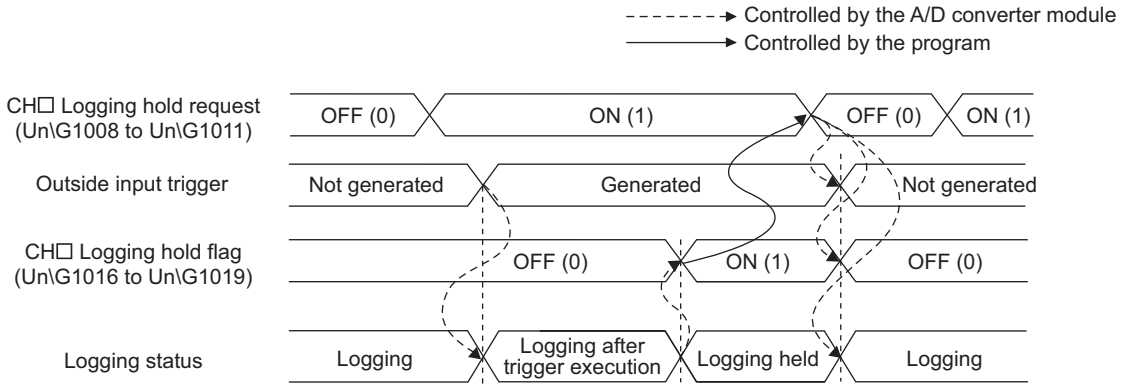
(2) Checking logging data

Refer to the following.

☞Page 149, Section 8.13.2 (3)

(3) Resuming the logging

To resume the logging, set CH□ Logging hold request (Un\G1008 to Un\G1011) to OFF (0). After logging resumes, collected data is stored from the head buffer memory area of the logging data storage area. In addition, OFF (0) is stored in CH□ Logging hold flag (Un\G1016 to Un\G1019).



After logging resumes, set CH□ Logging hold request (Un\G1008 to Un\G1011) to ON (1).

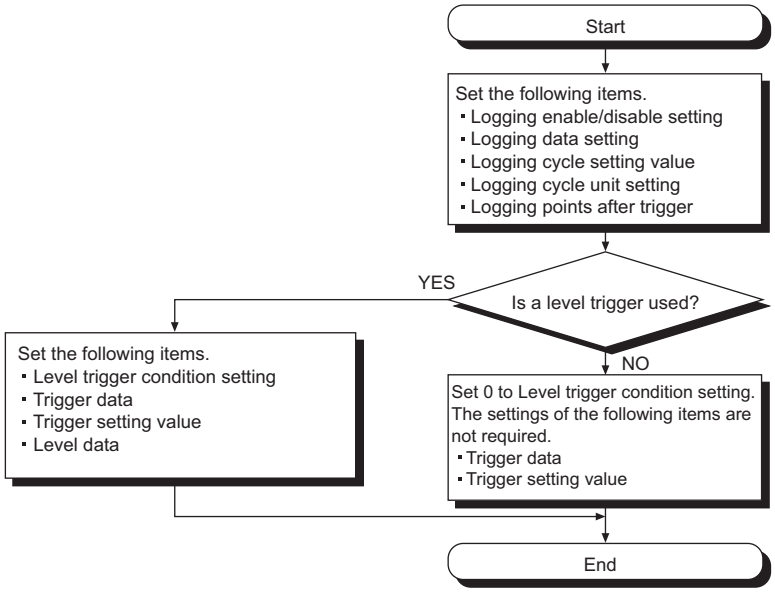
(a) Buffer memory status when logging resumes

Refer to the following.

☞Page 153, Section 8.13.3 (3) (a)

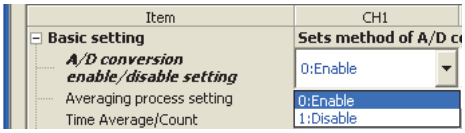
8.13.6 Setting method of a hold trigger (a request to stop logging)

(1) Setting procedure

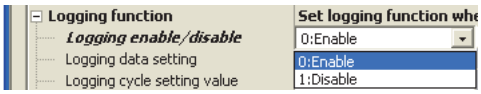


1. **Set "A/D conversion enable/disable setting" to "0: Enable".**

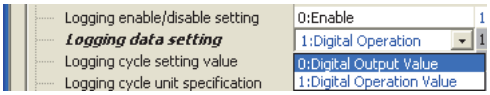
Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



2. **Set "Logging enable/disable setting" to "0: Enable".**



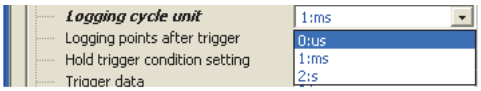
3. **Set the target data in "Logging data setting".**



4. **Set the cycle of storing logging data to "Logging cycle setting value".**



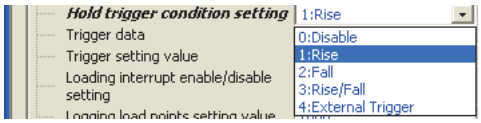
5. **Select a unit of "Logging cycle setting value" in "Logging cycle unit specification".**



6. **Set "Logging points after trigger" to the number of the data points collected for the time period from a hold trigger (a request to stop logging) occurrence to logging stop.**



7. **Select a condition of a hold trigger (a request to stop logging) in "Hold trigger condition setting". When "Hold trigger condition setting" is set to either "0: Logging hold request" or "4: Outside trigger", skip the procedure 8 to 10.**



8. Set an address of the buffer memory monitored to "Trigger data".



To monitor a device value of a module other than the A/D converter module such as a device of the CPU module, set a value between 1072 and 1081.

9. When "Trigger data" is set to a value between 1072 and 1081, transfer refreshed values of the monitored device to Level data □ (Un\G1072 to Un\G1081) one after another.

The following is an example of use of Level data □ (Un\G1072 to Un\G1081).

Ex. A program used to monitor the data register D100 of the CPU module and generate a CH1 level trigger

- Set CH1 Trigger data (Un\G1064) to 1073 (Level data 1).
- This program is used to write refreshed values in D100 to Level data 1 (Un\G1073) on after another (the head I/O No. is set to 10_H in the following program example).



10. Set "Trigger setting value" to a value which causes a level trigger.



8.14 Trigger Conversion Function

This function converts analog values into digital values according to the input of Trigger conversion request.
Trigger conversion request has two types: "External Trigger Convert Request (External Input Terminal)" and "Internal Trigger Conversion Request (Buffer Memory)".

Point

The A/D converter module converts analog values into digital values in all the channels where A/D conversion is enabled every time Trigger conversion request (External Trigger Convert Request (External Input Terminal) and Internal Trigger Conversion Request (Buffer Memory)) is input. However, the module does not execute A/D conversion when Trigger conversion request is not input.

(1) Definition of terms

Trigger conversion request is the generic term for External Trigger Convert Request (External Input Terminal) and Inside trigger conversion request (Un\G161).
External Trigger Convert Request (External Input Terminal) and Inside trigger conversion request (Un\G161) represent different requests.
The generic term for trigger input is "Trigger conversion request OFF → ON". The generic terms for each request are shown below.

- For External Trigger Convert Request (External Input Terminal), No external trigger request (OFF) → External trigger request (ON)
- For Inside trigger conversion request (Un\G161), No request (0) → Conversion request (1)

The following table lists the definition of terms in the trigger conversion function.

Generic term	ON/OFF operation	Trigger conversion name	ON/OFF request
Trigger conversion request	OFF → ON	External Trigger Convert Request (External Input Terminal)	No external trigger request (OFF) → External trigger request (ON)*1
	ON → OFF		External trigger request (ON) → No external trigger request (OFF)*1
	OFF → ON	Inside trigger conversion request (Un\G161)	No request (0) → Conversion request (1)
	ON → OFF		Conversion request (1) → No request (0)

*1 No external trigger request (OFF): OFF voltage/OFF current
External trigger request (ON): ON voltage/ON current
For details on the OFF voltage/OFF current and ON voltage/ON current of the external trigger, refer to the following.
• Performance specifications (☞ Page 26, Section 3.2)

(2) Restrictions of when the trigger conversion function is used

The following table lists the restrictions of when the trigger conversion function is used.

Function name	Restrictions	Error code
Averaging processing	Regardless of the setting in Averaging process setting (Un\G24), the sampling processing is performed.	–
Warning output function (rate alarm)	The warning output function (rate alarm) cannot be used. When Enabled (0) is set in CH□ Warning output setting (Un\G48.b8 to Un\G48.b11), an error occurs*1.	2200
Logging function	The logging function cannot be used. When Enable (0) is set in CH□ Logging enable/disable setting (Un\G1000 to Un\G1003), an error occurs*1.	
Shift function	The shift function cannot be used. When the shift function is set, the setting is ignored.	–
Difference conversion function	The difference conversion function cannot be used. When Trigger request (1) is set in CH□ Difference conversion trigger (Un\G172 to Un\G175), the setting is ignored.	–

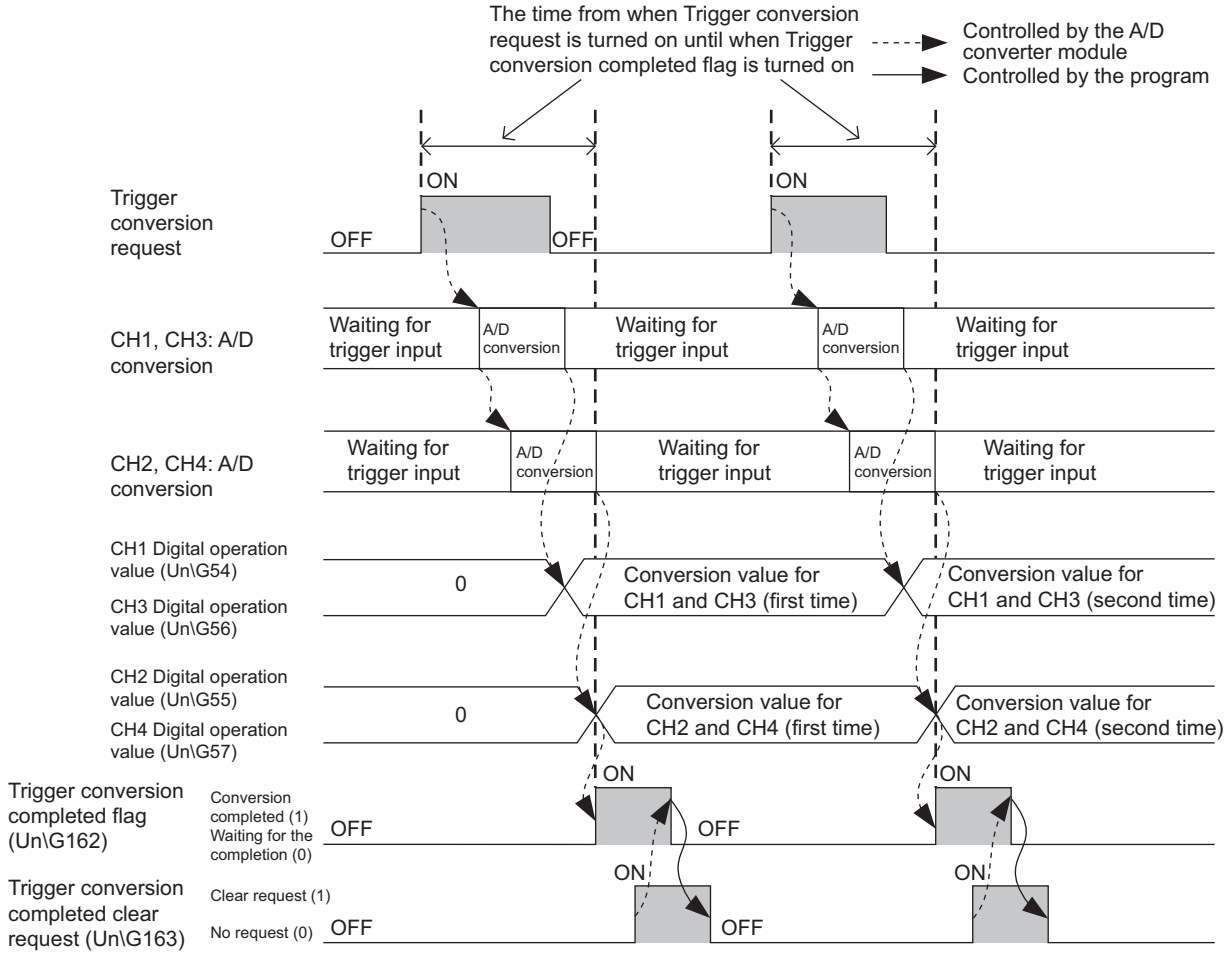
*1 Error code (2200) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on.

(3) Operation of the trigger conversion function

By setting A/D conversion-enabled channels or other necessary settings and turning off then on Operating condition setting request (Y9), trigger input gets ready to be accepted.
When Trigger conversion request is turned on once, analog values are converted into digital values in all the A/D conversion-enabled channels.

Ex. The following figure shows the operation between Trigger conversion request is turned on and Trigger conversion completed flag (Un\G162) is turned from Waiting for the completion (0) to Conversion completed (1) with the condition below.

- A/D conversion-enabled channels: 1CH, 2CH, 3CH, 4CH


The time from when Trigger conversion request is turned on until when Trigger conversion completed flag is turned on
Controlled by the A/D converter module
Controlled by the program
Trigger conversion request
ON
OFF
CH1, CH3: A/D conversion
Waiting for trigger input
A/D conversion
CH2, CH4: A/D conversion
CH1 Digital operation value (Un\G54)
CH3 Digital operation value (Un\G56)
0
Conversion value for CH1 and CH3 (first time)
Conversion value for CH1 and CH3 (second time)
CH2 Digital operation value (Un\G55)
CH4 Digital operation value (Un\G57)
Conversion value for CH2 and CH4 (first time)
Conversion value for CH2 and CH4 (second time)
Trigger conversion completed flag (Un\G162)
Conversion completed (1)
Waiting for the completion (0)
Trigger conversion completed clear request (Un\G163)
Clear request (1)
No request (0)

Point

- For the following conditions, Trigger conversion completed flag (Un\G162) is turned from Waiting for the completion (0) to Conversion completed (1) at the same time as A/D conversion is completed.
  - When the number of A/D conversion-enabled channels is one
  - When A/D conversion-enabled channels are only CH1 and CH3
  - When A/D conversion-enabled channels are only CH2 and CH4
- The function can be used only when "External Trigger Convert Request (External Input Terminal)" or "Internal Trigger Conversion Request (Buffer Memory)" is set to "A/D Conversion Timing" in "Switch Setting".
- When a value other than 0 or 1 is set to Inside trigger conversion request (Un\G161), an error occurs. Error code (2201) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on.
- When a value other than 0 or 1 is set to Trigger conversion completed clear request (Un\G163), an error occurs. Error code (2202) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on.

(4) Checking the A/D conversion timing

The setting of the A/D conversion timing can be checked with A/D conversion timing monitor value (Un\G160).

A/D conversion timing monitor value (Un\G160)	A/D conversion timing
0	Normal
1	External Trigger Convert Request (External Input Terminal)
2	Internal Trigger Conversion Request (Buffer Memory)

(5) Operation between the start of Trigger conversion and the completion

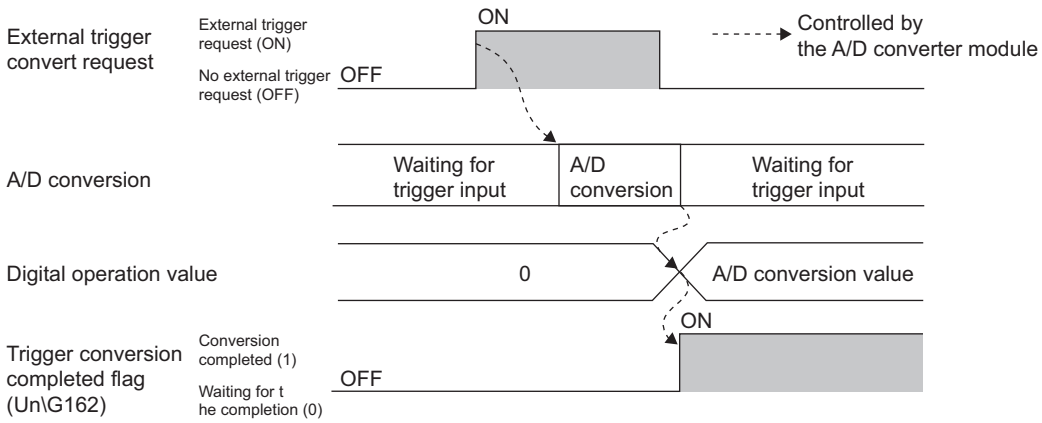
By turning on then off Operating condition setting request (Y9), the A/D converter module becomes the following condition and trigger conversion input gets ready to be accepted.

- Trigger conversion completed flag (Un\G162) turns to Waiting for the completion (0).
- A/D conversion completed flag (XE) turns off.
- A/D conversion completed flag (Un\G10) turns to During conversion or unused (0).

The following describes the operation between External Trigger Convert Request (External Input Terminal) or Inside trigger conversion request (Un\G161) is turned from No request (0) to Conversion request (1) and A/D conversion is completed.

(a) When using External Trigger Convert Request (External Input Terminal)

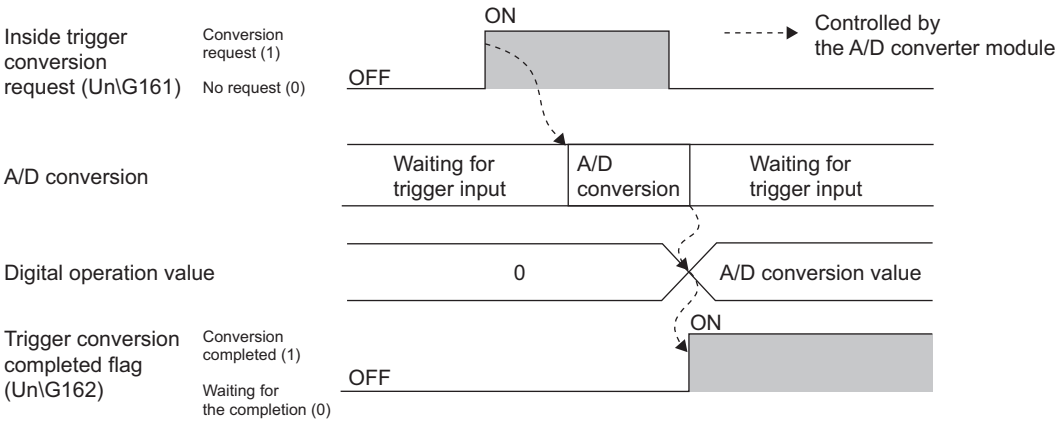
When External Trigger Convert Request (External Input Terminal) is turned from No external trigger request (OFF) to External trigger request (ON), the A/D converter module processes A/D conversion. When the A/D conversion is completed, Trigger conversion completed flag (Un\G162) is turned from Waiting for the completion (0) to Conversion completed (1).



Trigger conversion request	Start and completion of A/D conversion		Start method and completion condition
External trigger convert request	Start	External Trigger Convert Request (External Input Terminal)	No external trigger request (OFF) → External trigger request (ON)
	Completion	Trigger conversion completed flag (Un\G162)	Waiting for the completion (0) → Conversion completed (1)

(b) When using Inside trigger conversion request (Un\G161)

When Inside trigger conversion request (Un\G161) is turned from No request (0) to Conversion request (1), the A/D converter module processes A/D conversion. When the A/D conversion is completed, Trigger conversion completed flag (Un\G162) is turned from Waiting for the completion (0) to Conversion completed (1).



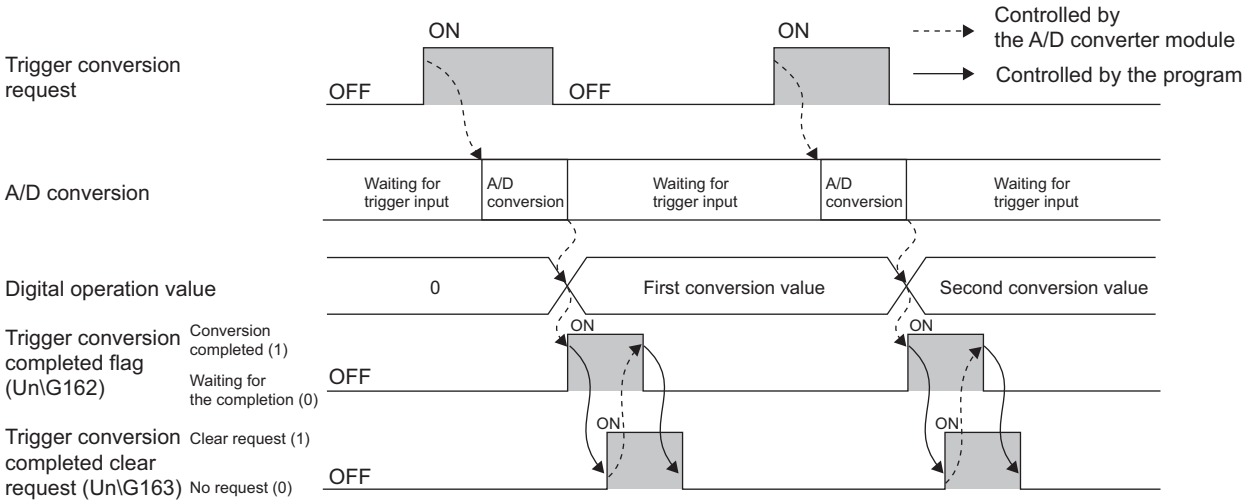
Trigger conversion request	Start and completion of A/D conversion		Start method and completion condition
Inside trigger conversion request	Start	Inside trigger conversion request (Un\G161)	No request (0) → Conversion request (1)
	Completion	Trigger conversion completed flag (Un\G162)	Waiting for the completion (0) → Conversion completed (1)

(6) Trigger conversion clear request

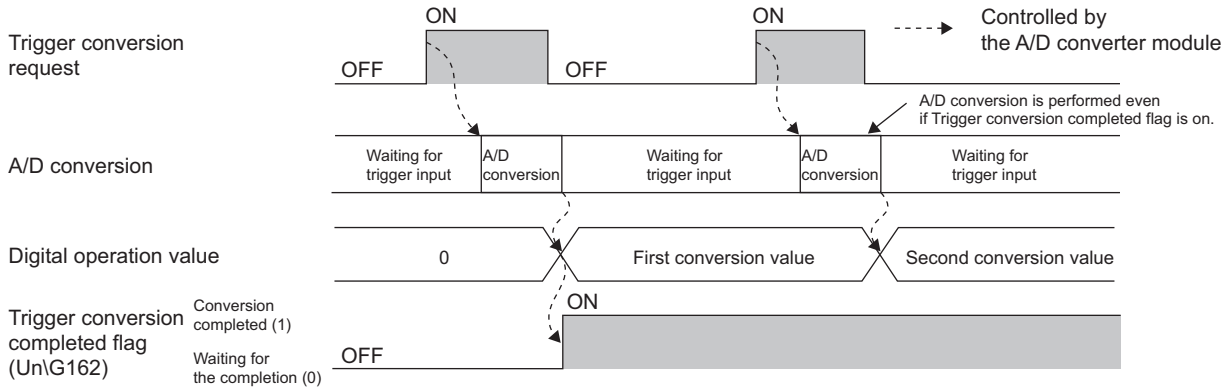
The following describes Trigger conversion clear request.

(a) Trigger conversion clear request

The following shows the operation where Trigger conversion completed flag (Un\G162) is turned from Waiting for the completion (0) to Conversion completed (1) by turning Trigger conversion completed clear request (Un\G163) from No request (0) to Clear request (1).



Even when Trigger conversion request is turned on while the setting in Trigger conversion completed flag (Un\G162) is Conversion completed (1), Trigger conversion request is accepted and digital output values and digital operation values are updated.



(b) Method of the trigger conversion completed clear request

- To use Trigger conversion completed flag (Un\G162) as an interlock for when "External Trigger Convert Request (External Input Terminal)" is set in "A/D Conversion Timing" in "Switch Setting", an interval between Trigger conversion requests is required considering the scan time. Set the interval between Trigger conversion requests about 5 times as long as the sequence scan time.
- To use Trigger conversion completed flag (Un\G162) as an interlock for when "Internal Trigger Conversion Request (Buffer Memory)" is set in "A/D Conversion Timing" in "Switch Setting", turn on Trigger conversion request after Trigger conversion completed flag (Un\G162) is turned from Conversion completed (1) to Waiting for the completion (0).

(7) Response time

The following tables list the response time of when Trigger conversion completed flag (Un\G162) is turned from Waiting for the completion (0) to Conversion completed (1) with "External Trigger Convert Request (External Input Terminal)" or " Internal Trigger Conversion Request (Buffer Memory)" set in "A/D Conversion Timing" in "Switch Setting".

(a) For External Trigger Convert Request (External Input Terminal)

A/D conversion enable/disable setting for CH1 and CH3	A/D conversion enable/disable setting for CH2 and CH4	Response time
Conversion enabled for CH1 or CH3, or both channels	Conversion disabled for both channels	140μs
Conversion disabled for both channels	Conversion enabled for CH2 or CH4, or both channels	140μs
Conversion enabled for CH1 or CH3, or both channels	Conversion enabled for CH2 or CH4, or both channels	180μs

(b) For Inside trigger conversion request (Un\G161)

A/D conversion enable/disable setting for CH1 and CH3	A/D conversion enable/disable setting for CH2 and CH4	Response time
Conversion enabled for CH1 or CH3, or both channels	Conversion disabled for both channels	2 × (ST + system time)*1
Conversion disabled for both channels	Conversion enabled for CH2 or CH4, or both channels	
Conversion enabled for CH1 or CH3, or both channels	Conversion enabled for CH2 or CH4, or both channels	

*1 ST indicates the sequence scan time and the system time indicates 1ms.

(8) Input interval and ON/OFF time of Trigger conversion request

The following tables list the ON time and OFF time of the items below for turning on Trigger conversion request. Turn on and off Trigger conversion request so that the reference values of each item are met.

- Trigger conversion request input interval
- Trigger conversion request ON time
- Trigger conversion request OFF time

(a) For External Trigger Convert Request (External Input Terminal)

The following table shows the input interval, ON time, and OFF time of Trigger conversion request when External Trigger Convert Request (External Input Terminal) is set.

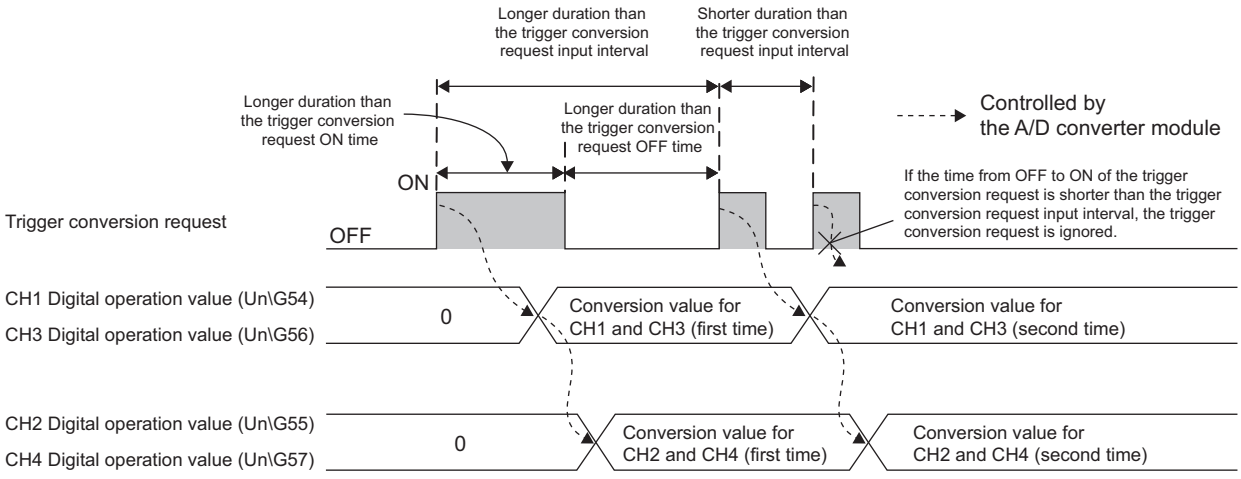
Item	Reference value for External Trigger Convert Request (External Input Terminal)
Trigger conversion request input interval	180μs
Trigger conversion request ON time	40μs
Trigger conversion request OFF time	40μs

(b) For Inside trigger conversion request (Un\G161)

The following table shows the input interval, ON time, and OFF time of the trigger conversion request when Inside trigger conversion request (Un\G161) is set.

Item	Reference value for Inside trigger conversion request (Un\G161)
Trigger conversion request input interval	2 × (ST + system time) or longer*1
Trigger conversion request ON time	ST + system time or longer*1
Trigger conversion request OFF time	ST + system time or longer*1

*1 ST indicates the sequence scan time and the system time indicates 1ms.


Longer duration than the trigger conversion request input interval
Shorter duration than the trigger conversion request input interval
Longer duration than the trigger conversion request ON time
Longer duration than the trigger conversion request OFF time
Controlled by the A/D converter module
ON
OFF
Trigger conversion request
If the time from OFF to ON of the trigger conversion request is shorter than the trigger conversion request input interval, the trigger conversion request is ignored.
CH1 Digital operation value (Un\G54)
CH3 Digital operation value (Un\G56)
0
Conversion value for CH1 and CH3 (first time)
Conversion value for CH1 and CH3 (second time)
CH2 Digital operation value (Un\G55)
CH4 Digital operation value (Un\G57)
0
Conversion value for CH2 and CH4 (first time)
Conversion value for CH2 and CH4 (second time)

(9) Setting procedure

For the setting procedure, refer to the following.

- Switch setting (☞Page 57, Section 7.2 (1))

8.15 Error Log Function

This function stores a history of errors and alarms that occurred in the A/D converter module to the buffer memory (Un\G1810 to Un\G1969).
A maximum of 16 errors and alarms can be stored.

(1) Process of the error history function

The error code and the error time are stored in the buffer memory address, starting from error history No.1 (start address Un\G1810) and sequentially thereafter. Error time is stored as follows:

Ex. For Error history No. 1

	b15 to b8	b7 to b0
Un\G1810	Error code	
Un\G1811	First two digits of the year	Last two digits of the year
Un\G1812	Month	Day
Un\G1813	Hour	Minute
Un\G1814	Second	Day of the week
Un\G1815 to Un\G1819	System area	

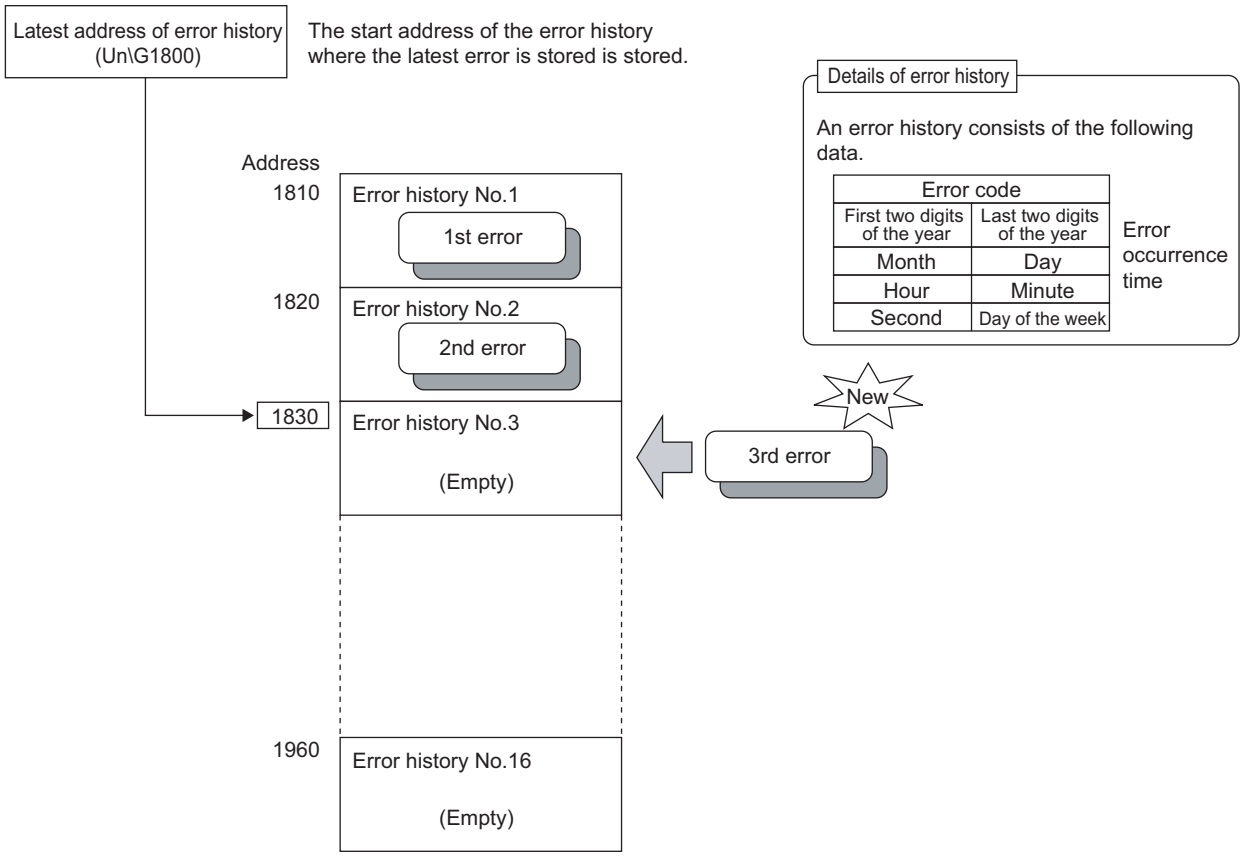
Item	Storage contents	Storage example*1
First two digits of the year/Last two digits of the year	Stored in BCD code.	2011_H
Month/Day		329_H
Hour/Minute		1035_H
Second		40_H
Day of the week	One of the following values is stored for each day of the week in BCD code. • Sunday: 0 • Monday: 1 • Tuesday: 2 • Wednesday: 3 • Thursday: 4 • Friday: 5 • Saturday: 6	2_H

*1 Those are values when an error occurs at 10:35:40 on Tuesday, March 29th, 2011.

(2) Checking the error history

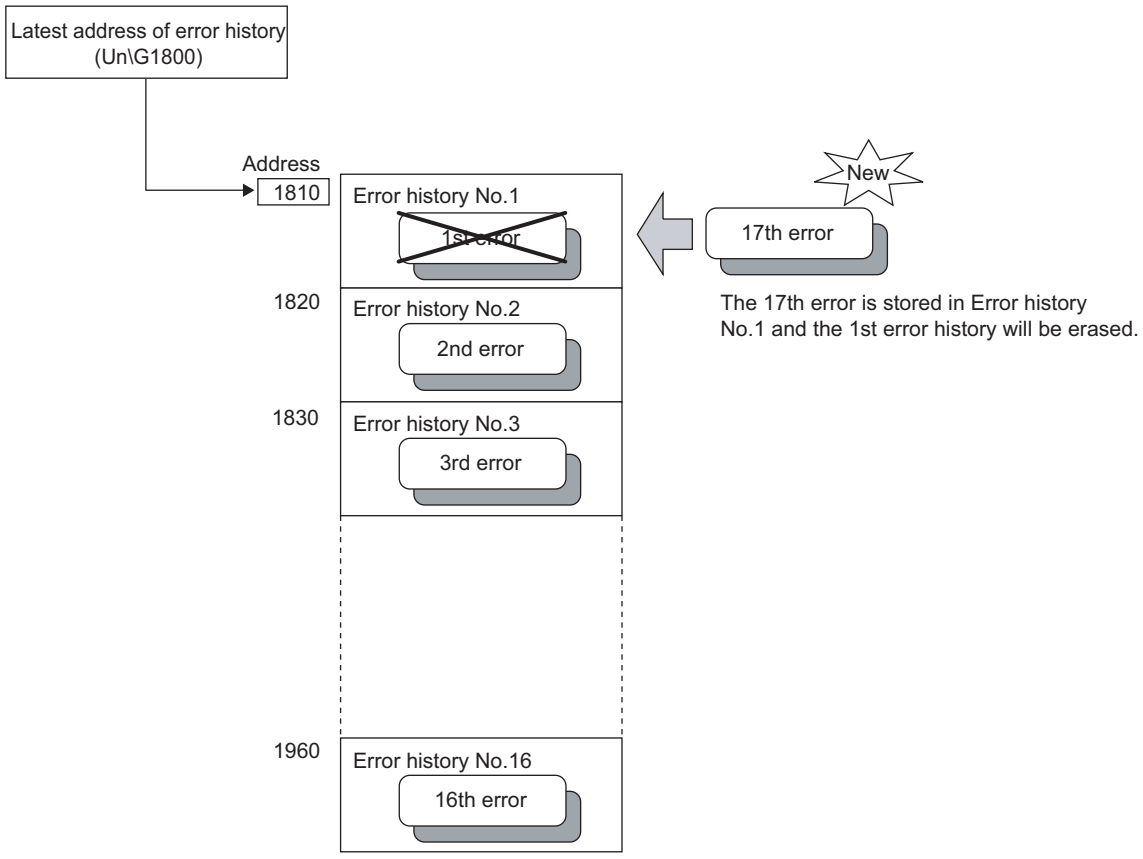
The start address of the error history where the latest error is stored can be checked in Latest address of error history (Un\G1800).

Ex. 1: When the third error occurs:
The third error is stored in Error history No.3, and the value "1830" (start address of Error history No.3) is stored to Latest address of error history (Un\G1800).



Ex. 2. When the 17th error occurs:

The 17th error is stored in Error history No.1, and the value "1810" (start address of Error history No.1) is stored to Latest address of error history (Un\G1800).

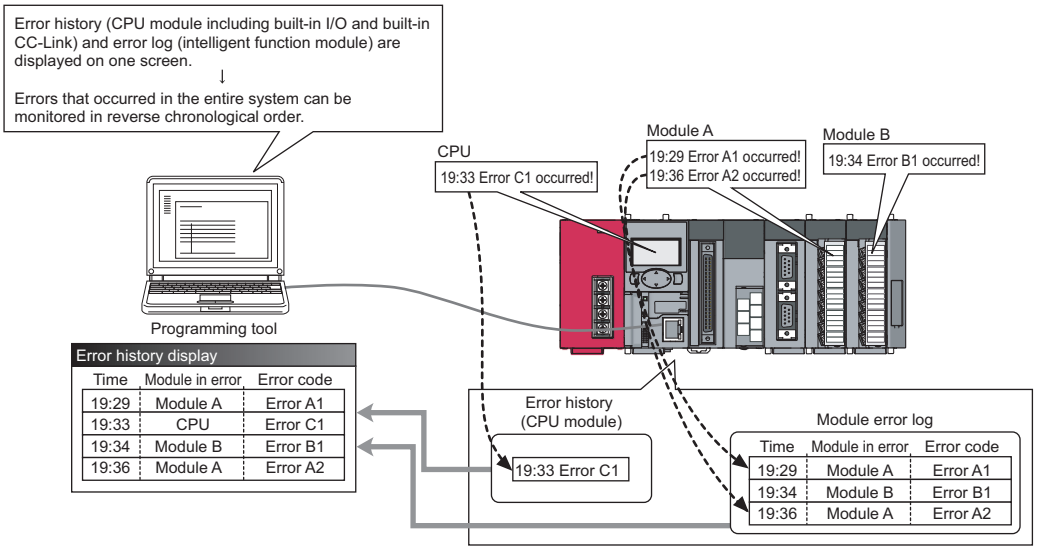


Point

- The same process for errors is used when an alarm occurs.
- Once the error history storage area becomes full, subsequent errors overwrite the existing data, starting from Error history No.1, and continue sequentially thereafter (Un\G1810 to Un\G1819). (The overwritten history is deleted.)
- The stored error history is cleared when the module is powered off, or when the CPU module is reset.

8.16 Module Error Collection Function

This function collects errors and alarms that occurred in the A/D converter module and stores them to the CPU module. By holding the module errors in a memory that can hold data in the event of power failure, the details on errors can be held even after the module is powered off or reset.


Error history (CPU module including built-in I/O and built-in CC-Link) and error log (intelligent function module) are displayed on one screen.
↓
Errors that occurred in the entire system can be monitored in reverse chronological order.
CPU
19:33 Error C1 occurred!
Module A
19:29 Error A1 occurred!
19:36 Error A2 occurred!
Module B
19:34 Error B1 occurred!
Programming tool
Error history display
Time Module in error Error code
19:29 Module A Error A1
19:33 CPU Error C1
19:34 Module B Error B1
19:36 Module A Error A2
Error history (CPU module)
19:33 Error C1
Module error log
Time Module in error Error code
19:29 Module A Error A1
19:34 Module B Error B1
19:36 Module A Error A2

[Example of screen display]

No.	Error Code	Date and Time	Model Name	Start I/O
00125	0070	2009/12/10 17:02:37	L60AD4	0030
00124	0070	2009/12/10 17:00:05	L60AD4	0030
00123	0CE4	2009/12/10 17:00:04	L26CPU-BT	----
00122	05DC	2009/12/10 16:15:50	L26CPU-BT	----
00121	0070	2009/12/10 15:59:30	L60DA4	0030
00120	0070	2009/12/10 15:45:02	L60DA4	0010
00119	05DC	2009/12/10 14:14:38	L26CPU-BT	----
00118	0070	2009/12/10 14:12:03	L60DA4	0010
00117	0CE4	2009/12/10 13:59:54	L26CPU-BT	----
00116	0CE4	2009/12/10 13:35:11	L26CPU-BT	----
00115	05DC	2009/12/10 11:11:45	L26CPU-BT	----
00114	0070	2009/12/10 11:07:05	L60AD4	0010
00113	0CE4	2009/12/10 11:07:04	L26CPU-BT	----
00112	0070	2009/12/10 11:03:49	L60AD4	0010
00111	0CE4	2009/12/10 11:03:48	L26CPU-BT	----
00110	05DC	2009/12/09 16:30:58	L26CPU-BT	----
00109	0070	2009/12/09 16:29:33	L60DA4	0010
00108	0070	2009/12/09 16:29:12	L60DA4	0010
00107	083B	2009/12/09 16:29:11	L26CPU-BT	----

Point

For details on the module error collection function, refer to the following.

MELSEC-L CPU Module User's Manual (Function Explanation, Program Fundamentals)

8.17 Error Clear Function

This function clears the error from the system monitor when an error occurs.

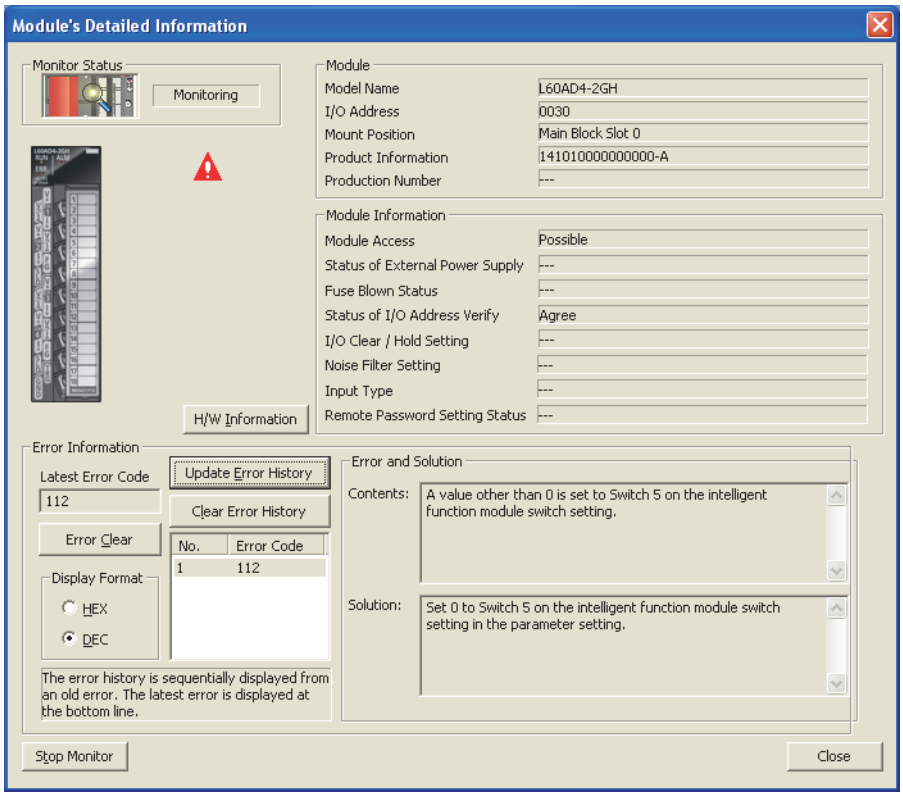
By clicking the Error Clear button in the system monitor, the latest error code stored in Latest error code (Un\G19) is cleared and the ERR. LED turns off. The operation is the same as that for Error clear request (YF) and clearing the error from the display unit.

However, the error history cannot be cleared with the button.

For instructions on Error clear request (YF) and clearing the error from the display unit, refer to the following.

- Error clear request (YF) (Page 239, Appendix 1 (4))
- Checking and Clearing Errors (Page 195, Section 9.4)

[Diagnostics] ⇨ [System Monitor] ⇨ Error Module

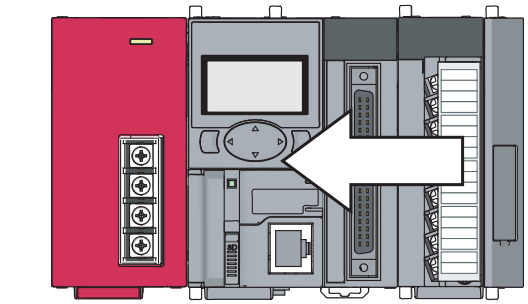


8.18 Saving and Restoring Offset/gain Values

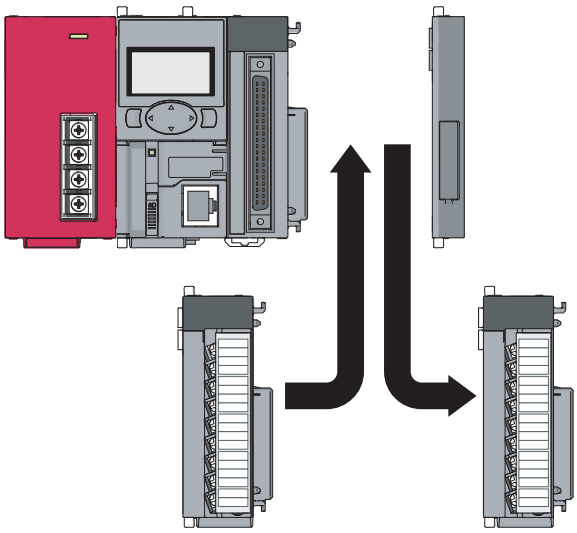
The offset/gain value of the user range setting (uni-polar: current) and user range setting (bi-polar: voltage) can be saved and restored in the A/D conversion module.
In the event that the A/D converter module fails and needs to be replaced, the offset/gain values of the failed A/D converter module can be restored onto the replaced A/D converter module.
In addition, if multiple A/D converter modules are connected on a system, the offset/gain settings in one of the modules can be applied to the other modules.
However, if the offset/gain values are saved and restored, the accuracy after the restoration decreases by approximately three times compared to that before the restoration.
Reconfigure the offset/gain when required.

(1) Procedure for saving and restoring offset/gain values

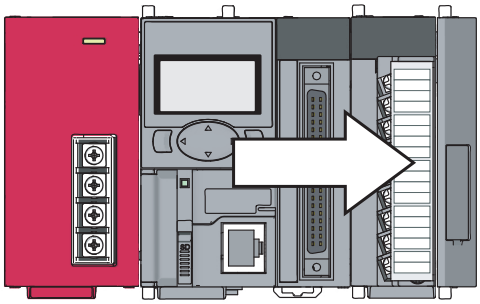
(a) To restore offset/gain values onto a new replaced module:



1. **Save the offset/gain values.**



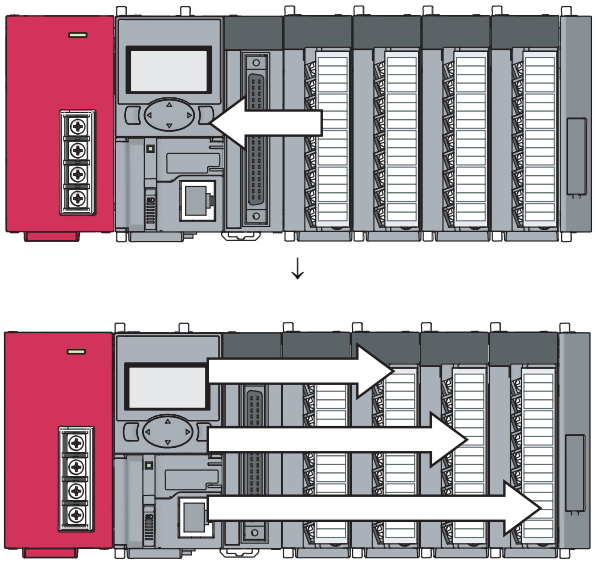
2. **Replace the A/D converter module.**



3. **Restore the offset/gain values.**

(b) To apply the offset/gain values set in one module to the other modules in the same system:

Ex. When the offset/gain setting in module No.1 is applied to modules No.2 to No.4



1. **Save the offset/gain values of module No.1.**

2. **Apply the offset/gain values to modules No.2 to No.4.**

(2) Methods for saving and restoring offset/gain values

There are two methods for saving and restoring offset/gain values.

- Saving and restoring by dedicated instructions
- Saving and restoring by reading from and writing to the buffer memory

(a) Saving and restoring by dedicated instructions

Use the dedicated instruction G(P).OGLOAD to temporarily save the offset/gain values of the source A/D converter module to the internal device of the CPU, then use G(P).OGSTOR to write the values to the destination A/D converter module.

Prevent the saved offset/gain value data from being deleted, by one of the following methods before replacing the modules:

- Use latch settings for the internal device of the destination module.
- Save the data onto an SD memory card.
  To write data: use the SP.FWRITE instruction.
  To read data: use the SP.FREAD instruction.
- Store the saved data.

For use of dedicated instructions, refer to the following.

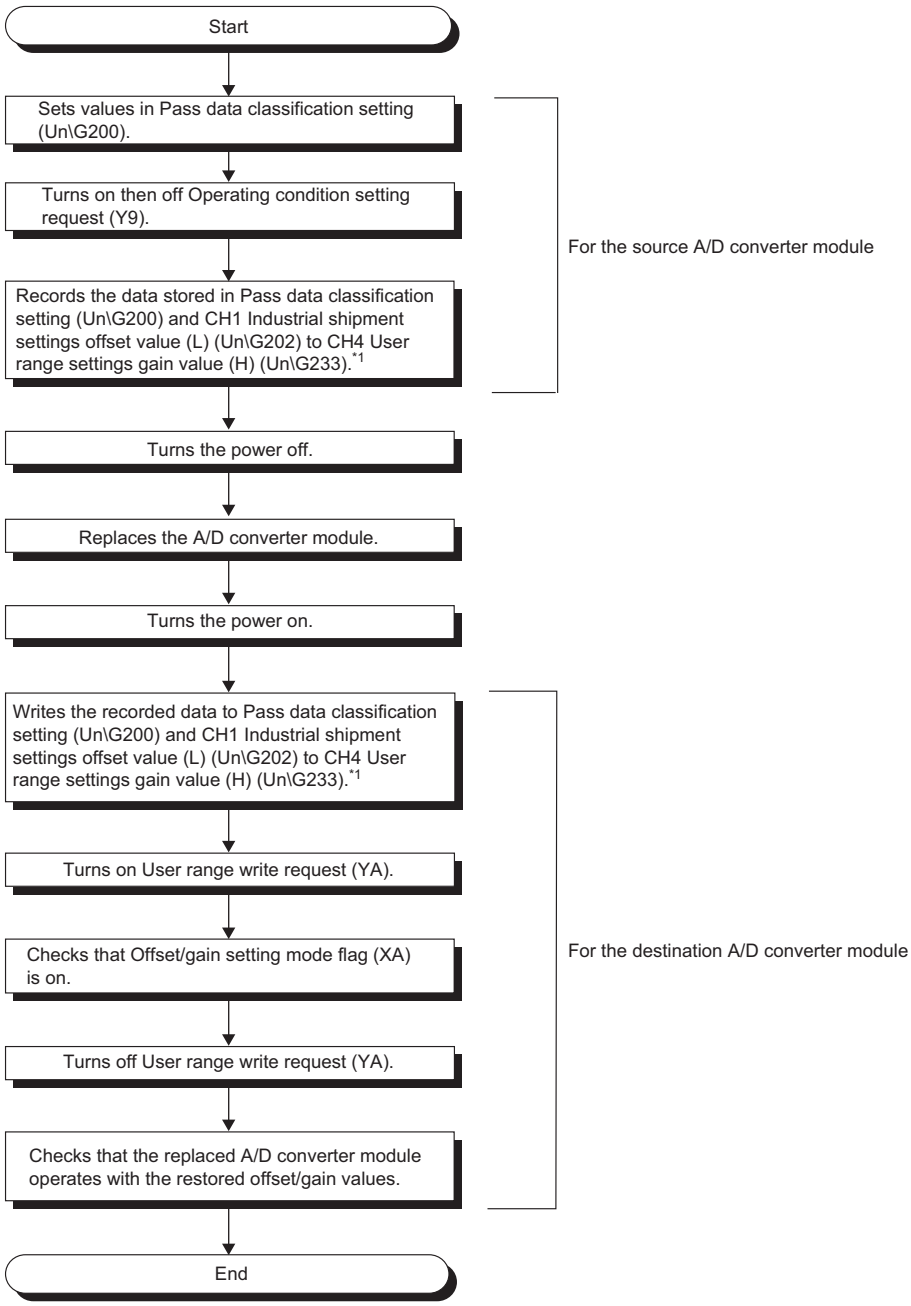
- Dedicated Instruction (☞ Page 285, Appendix 5)

(b) Saving and restoring by reading from and writing to the buffer memory

Use Pass data classification setting (Un\G200), CH1 Industrial shipment setting offset value (L) (Un\G202) to CH4 User range setting gain value (H) (Un\G233), and User range write request (YA) to read the offset/gain values from the source A/D converter module, then use the buffer memory again to write the values to the destination A/D converter module.

The following describes the procedure for using the buffer memory.

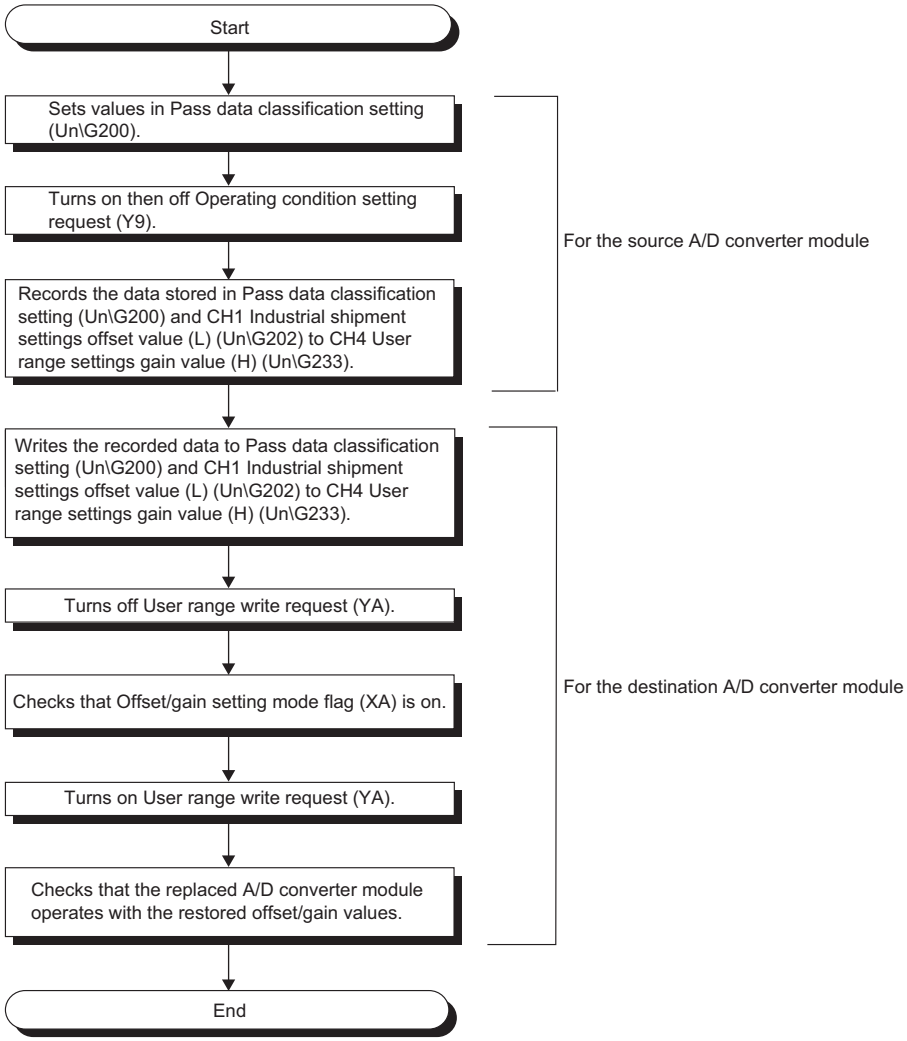
[To restore offset/gain values onto a new replaced module]


Start
Sets values in Pass data classification setting (Un\G200).
Turns on then off Operating condition setting request (Y9).
Records the data stored in Pass data classification setting (Un\G200) and CH1 Industrial shipment settings offset value (L) (Un\G202) to CH4 User range settings gain value (H) (Un\G233).*1
For the source A/D converter module
Turns the power off.
Replaces the A/D converter module.
Turns the power on.
Writes the recorded data to Pass data classification setting (Un\G200) and CH1 Industrial shipment settings offset value (L) (Un\G202) to CH4 User range settings gain value (H) (Un\G233).*1
Turns on User range write request (YA).
Checks that Offset/gain setting mode flag (XA) is on.
Turns off User range write request (YA).
Checks that the replaced A/D converter module operates with the restored offset/gain values.
For the destination A/D converter module
End

*1 When replacing modules, prevent the saved offset/gain value data from being deleted, by one of the following methods before powering off the module.

- Use latch settings for the internal device of the destination module.
- Save the data onto an SD memory card.
  To write data: use the SP.FWRITE instruction.
  To read data: use the SP.FREAD instruction.
- Store the saved data.

[To apply the offset/gain values set in one module to the other modules]


Start
Sets values in Pass data classification setting (Un\G200).
Turns on then off Operating condition setting request (Y9).
Records the data stored in Pass data classification setting (Un\G200) and CH1 Industrial shipment settings offset value (L) (Un\G202) to CH4 User range settings gain value (H) (Un\G233).
For the source A/D converter module
Writes the recorded data to Pass data classification setting (Un\G200) and CH1 Industrial shipment settings offset value (L) (Un\G202) to CH4 User range settings gain value (H) (Un\G233).
Turns off User range write request (YA).
Checks that Offset/gain setting mode flag (XA) is on.
Turns on User range write request (YA).
Checks that the replaced A/D converter module operates with the restored offset/gain values.
For the destination A/D converter module
End

(3) Range reference tables

The following describes the reference ranges to be used for saving and restoring offset/gain values.

(a) Reference table for CH1 Industrial shipment setting offset value (L) (Un\G202) to CH4 Industrial shipment setting gain value (H) (Un\G217)

The reference values vary depending on the setting of Pass data classification setting (Un\G200) (voltage or current).

Address (decimal)				Description	Pass data classification setting	Reference value (hexadecimal)
CH1	CH2	CH3	CH4			
202, 203	206, 207	210, 211	214, 215	Industrial shipment setting offset value	Voltage	Approx. 00000000_H
					Current	Approx. 00000000_H
204, 205	208, 209	212, 213	216, 217	Industrial shipment setting gain value	Voltage	Approx. $0000C51E_H$
					Current	Approx. $0000C51E_H$

(b) Reference table for CH1 User range setting offset value (L) (Un\G218) to CH4 User range setting gain value (H) (Un\G233)

Offset/gain value		Reference value (hexadecimal)
Voltage	0V	Approx. 00000000_H
	1V	Approx. $000013B6_H$
	5V	Approx. $0000628F_H$
	10V	Approx. $0000C51E_H$
Current	0mA	Approx. 00000000_H
	4mA*1	Approx. $0000276C_H$
	20mA*2	Approx. $0000C51E_H$

*1 This value is stored in User range setting offset value by default.

*2 This value is stored in User range setting gain value by default.

CHAPTER 9 DISPLAY UNIT

This chapter describes the functions of the display unit that can be used with the A/D converter module.
For instruction on operating the display unit, or for details on the functions and menu configuration, refer to the following.

MELSEC-L CPU Module User's Manual (Function Explanation, Program Fundamentals)

9.1 Display Unit

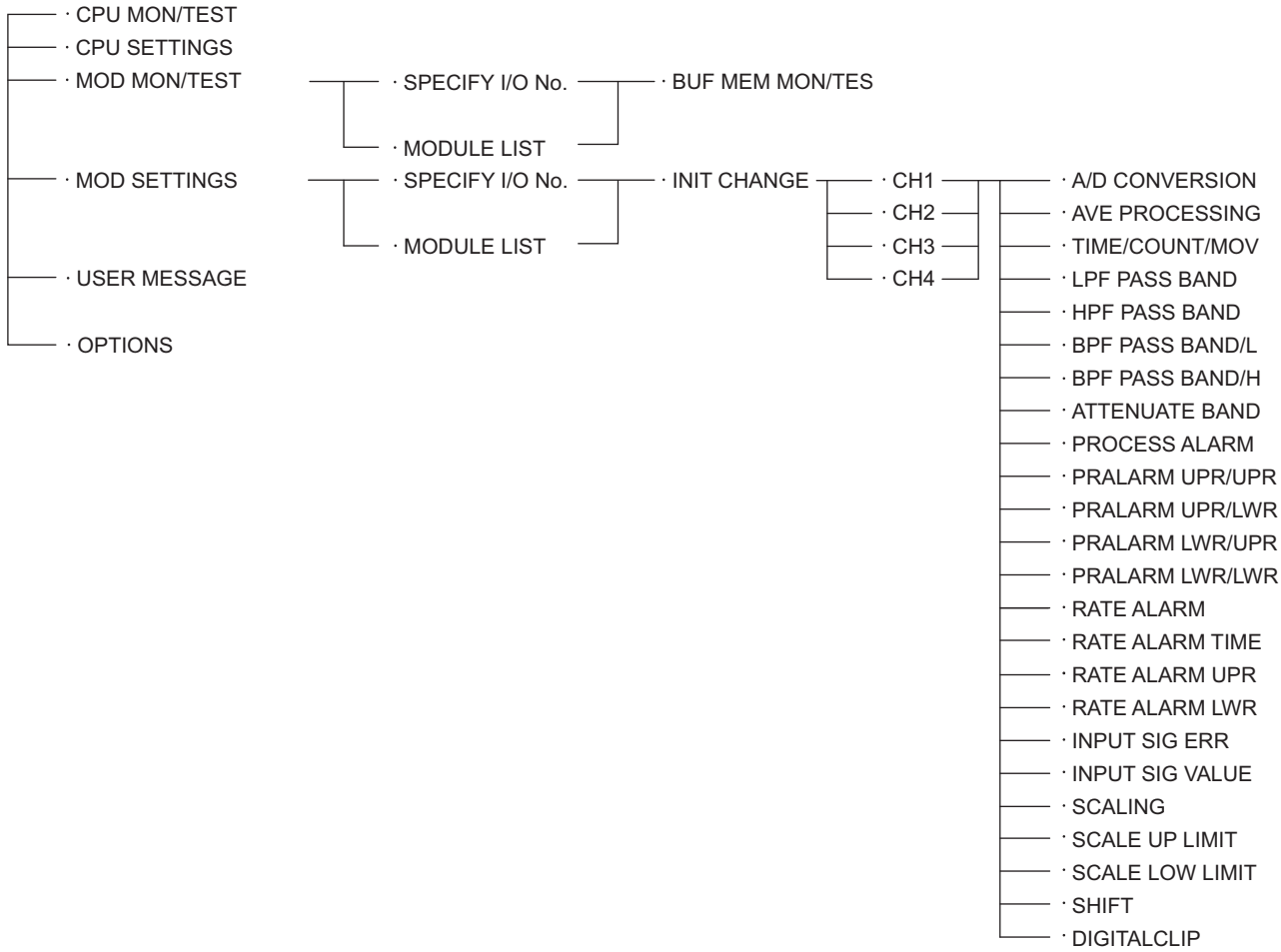
The display unit is an LCD attachable to the CPU module. By attaching it to the CPU module, the status of the system can be checked and the system settings can be changed without the software package.
In addition, if a problem occurs, the cause of the problem can be identified by displaying the error information.
For details on how to check and clear an error from the display unit, refer to the following.

- Checking and Clearing Errors (Page 195, Section 9.4)

9.2 Menu Transition

(1) Organization

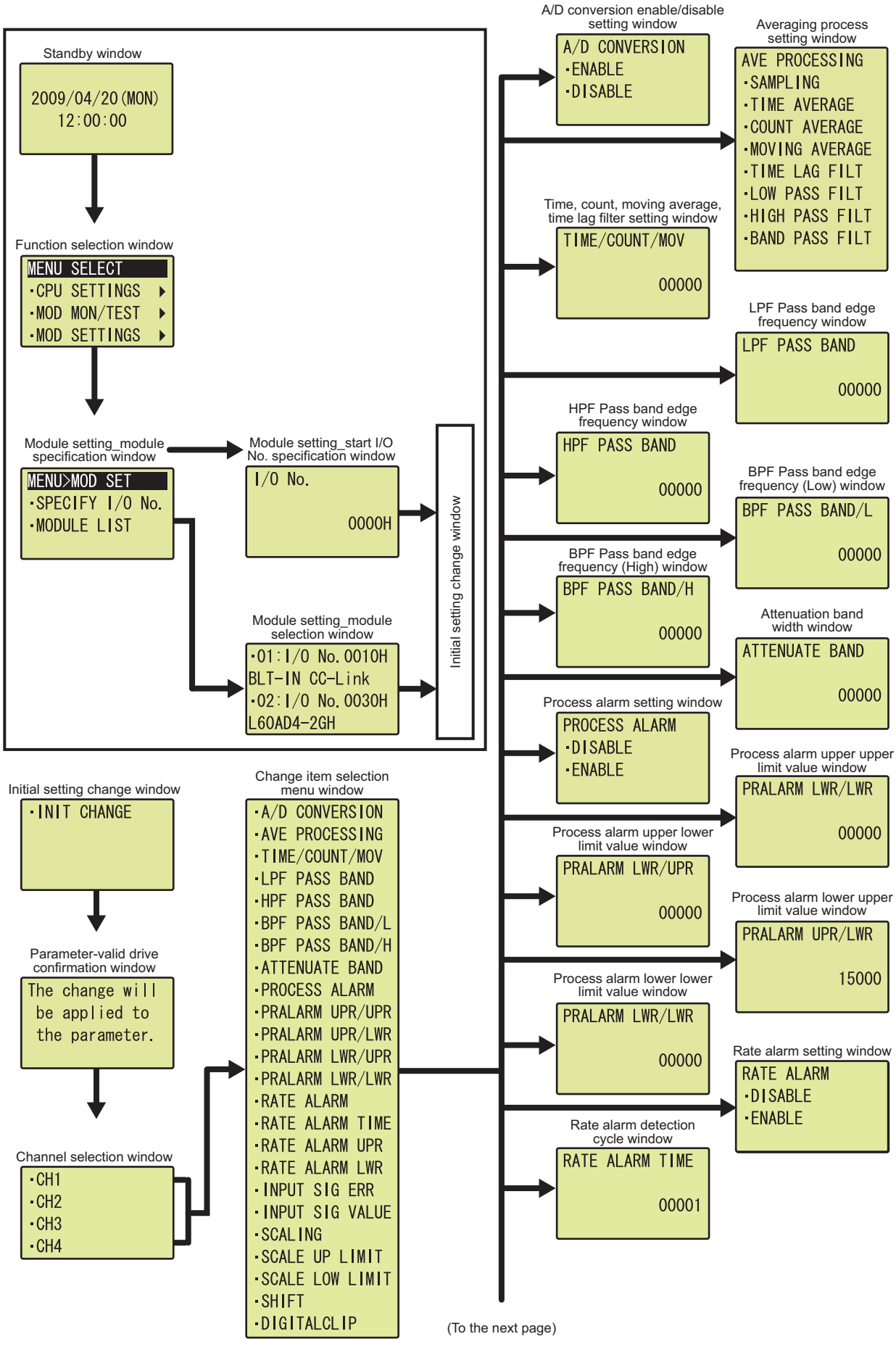
The following diagram shows how the "MOD MON/TEST" and "MOD SETTINGS" menus are organized.



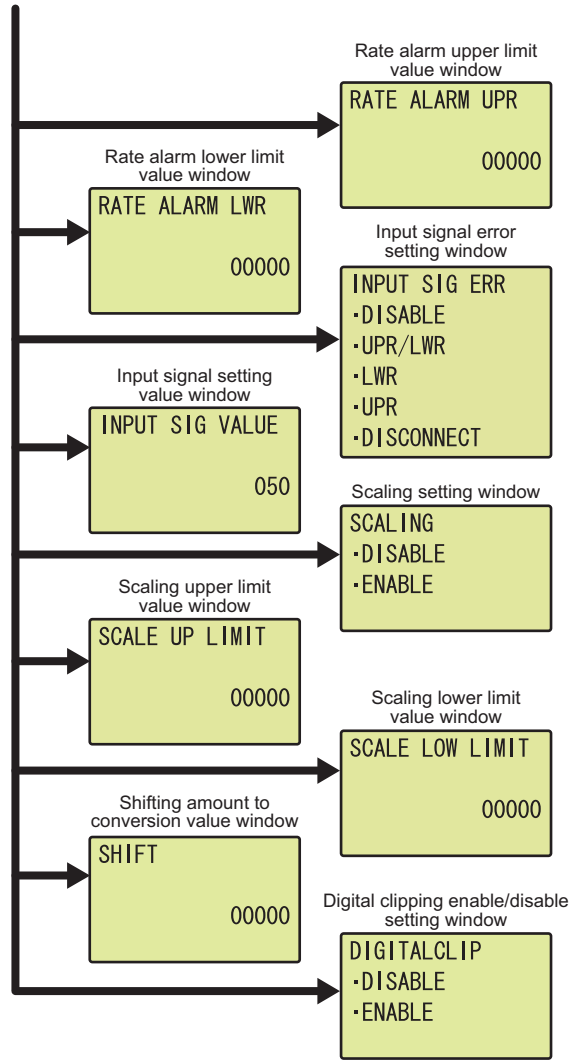
*1 The shift function is enabled by turning the CPU module STOP → RUN → STOP → RUN as well as other modules.

(2) Window transitions up to the initial setting change window

The following diagram shows how the windows transition to the initial setting change window.


Standby window
2009/04/20(MON)
12:00:00
Function selection window
MENU SELECT
·CPU SETTINGS
·MOD MON/TEST
·MOD SETTINGS
Module setting_module specification window
MENU>MOD SET
·SPECIFY I/O No.
·MODULE LIST
Module setting_start I/O No. specification window
I/O No.
0000H
Module setting_module selection window
·01:I/O No.0010H
BLT-IN CC-Link
·02:I/O No.0030H
L60AD4-2GH
Initial setting change window
Initial setting change window
·INIT CHANGE
Parameter-valid drive confirmation window
The change will be applied to the parameter.
Channel selection window
·CH1
·CH2
·CH3
·CH4
Change item selection menu window
·A/D CONVERSION
·AVE PROCESSING
·TIME/COUNT/MOV
·LPF PASS BAND
·HPF PASS BAND
·BPF PASS BAND/L
·BPF PASS BAND/H
·ATTENUATE BAND
·PROCESS ALARM
·PRALARM UPR/UPR
·PRALARM UPR/LWR
·PRALARM LWR/UPR
·PRALARM LWR/LWR
·RATE ALARM
·RATE ALARM TIME
·RATE ALARM UPR
·RATE ALARM LWR
·INPUT SIG ERR
·INPUT SIG VALUE
·SCALING
·SCALE UP LIMIT
·SCALE LOW LIMIT
·SHIFT
·DIGITALCLIP
A/D conversion enable/disable setting window
A/D CONVERSION
·ENABLE
·DISABLE
Averaging process setting window
AVE PROCESSING
·SAMPLING
·TIME AVERAGE
·COUNT AVERAGE
·MOVING AVERAGE
·TIME LAG FILT
·LOW PASS FILT
·HIGH PASS FILT
·BAND PASS FILT
Time, count, moving average, time lag filter setting window
TIME/COUNT/MOV
00000
LPF Pass band edge frequency window
LPF PASS BAND
00000
HPF Pass band edge frequency window
HPF PASS BAND
00000
BPF Pass band edge frequency (Low) window
BPF PASS BAND/L
00000
BPF Pass band edge frequency (High) window
BPF PASS BAND/H
00000
Attenuation band width window
ATTENUATE BAND
00000
Process alarm setting window
PROCESS ALARM
·DISABLE
·ENABLE
Process alarm upper upper limit value window
PRALARM LWR/LWR
00000
Process alarm upper lower limit value window
PRALARM LWR/UPR
00000
Process alarm lower upper limit value window
PRALARM UPR/LWR
15000
Process alarm lower lower limit value window
PRALARM LWR/LWR
00000
Rate alarm setting window
RATE ALARM
·DISABLE
·ENABLE
Rate alarm detection cycle window
RATE ALARM TIME
00001
(To the next page)

(From the previous page)



9.3 List of Setting Value Change Windows

The following table lists the setting value change windows.

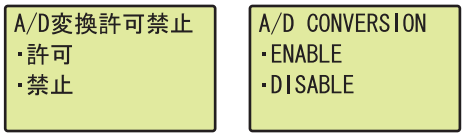
(1) Displayed in English:

Name		Window format	Input limits	
Setting item	Window display		Upper limit	Lower limit
A/D conversion enable/disable setting	A/D CONVERSION	Selection	–	–
Average processing setting	AVE PROCESSING	Selection	–	–
Time Average/Count Average/ Moving Average/Time Constant	TIME/COUNT/MOV	Numeric	65000	0
LPF Pass band end frequency	LPF PASS BAND	Numeric	32767	0
HPF Pass band end frequency	HPF PASS BAND	Numeric	32767	0
BPF Pass band end frequency (Low)	BPF PASS BAND/L	Numeric	32767	0
BPF Pass band end frequency (High)	BPF PASS BAND/H	Numeric	32767	0
Attenuate band	ATTENUATE BAND	Numeric	32767	0
Warning output function (Process Alarm)	PROCESS ALARM	Selection	–	–
Process alarm upper upper limit value	PRALARM UPR/UPR	Numeric	32767	-32768
Process alarm upper lower limit value	PRALARM UPR/LWR	Numeric	32767	-32768
Process alarm lower upper limit value	PRALARM LWR/UPR	Numeric	32767	-32768
Process alarm lower lower limit value	PRALARM LWR/LWR	Numeric	32767	-32768
Warning output function (Rate Alarm)	RATE ALARM	Selection	–	–
Rate alarm detect cycle time	RATE ALARM TIME	Numeric	32000	1
Rate alarm upper limit value	RATE ALARM UPR	Numeric	32767	-32768
Rate alarm lower limit value	RATE ALARM LWR	Numeric	32767	-32768
Input signal error detection function	INPUT SIG ERR	Selection	–	–
Warning output function(Rate Alarm)	INPUT SIG VALUE	Numeric	250	0
Scaling function	SCALING	Selection	–	–
Scaling upper limit value	SCALE UP LIMIT	Numeric	32000	-32000
Scaling lower limit value	SCALE LOW LIMIT	Numeric	32000	-32000
Shift function	SHIFT	Numeric	32767	-32768
Digitalclip function	DIGITALCLIP	Selection	–	–

(2) A/D conversion enable/disable setting

Select "ENABLE" or "DISABLE" in the "A/D CONVERSION" window.

"A/D CONVERSION" window



1. **Use the ▲ and ▼ buttons to select "ENABLE" or "DISABLE", and confirm with the OK button.**

(3) Averaging process setting

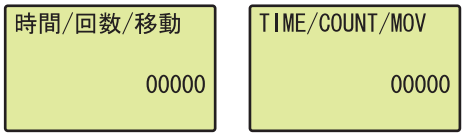
In the "AVE PROCESSING" window, select whether to perform sampling processing, averaging processing (time average, count average, moving average), time lag filter, or digital filter.

"AVE PROCESSING" window



↓

"TIME/COUNT/MOV" window



1. **Use the ▲ and ▼ buttons to select the detection method from the following, and confirm with the OK button.**

- SAMPLING
- TIME AVERAGE
- COUNT AVERAGE
- MOVING AVERAGE
- TIME LAG FILTER
- LOW PASS FILTER
- HIGH PASS FILTER
- BAND PASS FILTER

2. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor using the ▲ and ▼ buttons respectively. Confirm with the OK button.**

Table of input items

Input item	Input range	
	Input upper limit	Input lower limit
TIME	5000	2
COUNT	65000	4
MOV	1000	2
TIME LAG FILTER	500	1

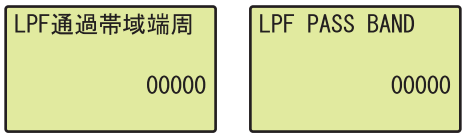
Point

A value between 0 and 65000 can be input for any type of averaging processing on the display unit. However, if the value is outside the setting range of the selected averaging processing, an error occurs on the A/D converter module side.

(4) LPF Pass band edge frequency

Set the LPF Pass band edge frequency in the "LPF PASS BAND" window.

"LPF PASS BAND" window



1. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor using the ▲ and ▼ buttons respectively. Confirm with the OK button.**

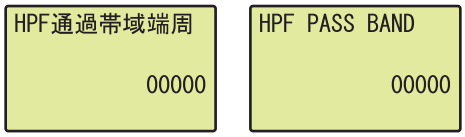
Table of input items

Input item	Input range	
	Input upper limit	Input lower limit
LPF PASS BAND	32767	0

(5) HPF Pass band edge frequency

Set the HPF Pass band edge frequency in the "HPF PASS BAND" window.

"HPF PASS BAND" window



1. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor using the ▲ and ▼ buttons respectively. Confirm with the OK button.**

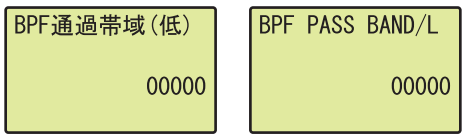
Table of input items

Input item	Input range	
	Input upper limit	Input lower limit
HPF PASS BAND	32767	0

(6) BPF Pass band edge frequency (Low)

Set the BPF Pass band edge frequency (Low) in the "BPF PASS BAND/L" window.

"BPF PASS BAND/L" window



1. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor using the ▲ and ▼ buttons respectively. Confirm with the OK button.**

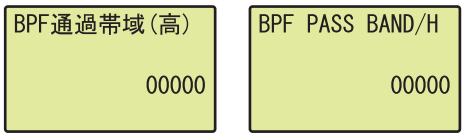
Table of input items

Input item	Input range	
	Input upper limit	Input lower limit
BPF PASS BAND/L	32767	0

(7) BPF Pass band edge frequency (High)

Set the BPF Pass band edge frequency (High) in the "BPF PASS BAND/H" window.

"BPF PASS BAND/H" window



1. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor using the ▲ and ▼ buttons respectively. Confirm with the OK button.**

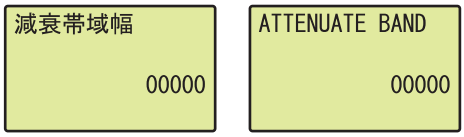
Table of input items

Input item	Input range	
	Input upper limit	Input lower limit
BPF PASS BAND/H	32767	0

(8) Attenuate band width

Set the attenuate band width in the "ATTENUATE BAND" window.

"ATTENUATE BAND" window



1. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor using the ▲ and ▼ buttons respectively. Confirm with the OK button.**

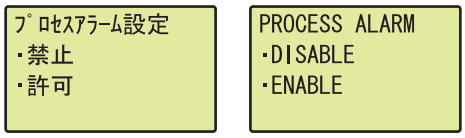
Table of input items

Input item	Input range	
	Input upper limit	Input lower limit
ATTENUATE BAND	32767	0

(9) Process alarm setting

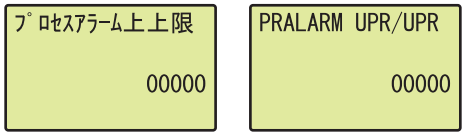
Select "DISABLE" or "ENABLE" in the "PROCESS ALARM" window.

"PROCESS ALARM" window



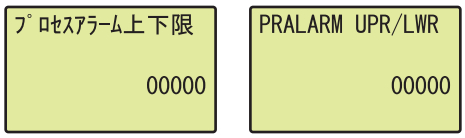
↓

"PRALARM UPR/UPR" window



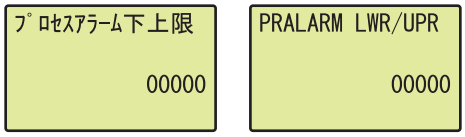
↓

"PRALARM UPR/LWR" window



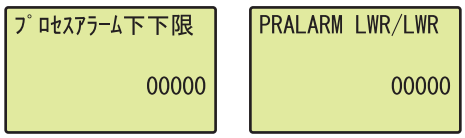
↓

"PRALARM LWR/UPR" window



↓

"PRALARM LWR/LWR" window



1. **Use the ▲ and ▼ buttons to select "DISABLE" or "ENABLE", and confirm with the OK button. (When "ENABLE" is selected, follow the rest of the procedure.)**

2. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor using the ▲ and ▼ buttons respectively. Confirm with the OK button.**

3. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor using the ▲ and ▼ buttons respectively. Confirm with the OK button.**

4. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor using the ▲ and ▼ buttons respectively. Confirm with the OK button.**

5. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor using the ▲ and ▼ buttons respectively. Confirm with the OK button.**

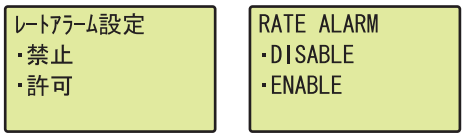
Table of input items

Input item	Input range	
	Input upper limit	Input lower limit
PRALARM UPR/UPR	32767	-32768
PRALARM UPR/LWR		
PRALARM LWR/UPR		
PRALARM LWR/LWR		

(10)Rate alarm setting

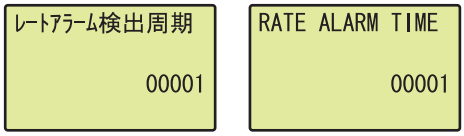
Select "DISABLE" or "ENABLE" in the "RATE ALARM" window.

"RATE ALARM" window



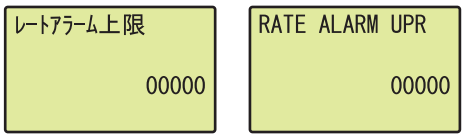
↓

"RATE ALARM TIME" window



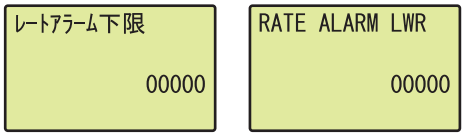
↓

"RATE ALARM UPR" window



↓

"RATE ALARM LWR" window



1. **Use the ▲ and ▼ buttons to select "DISABLE" or "ENABLE", and confirm with the OK button. (When "ENABLE" is selected, follow the rest of the procedure.)**

2. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor using the ▲ and ▼ buttons respectively. Confirm with the OK button.**

3. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor using the ▲ and ▼ buttons respectively. Confirm with the OK button.**

4. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor using the ▲ and ▼ buttons respectively. Confirm with the OK button.**

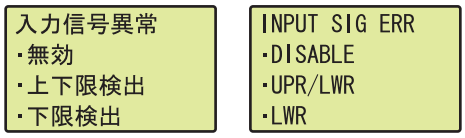
Table of input items

Input item	Input range	
	Input upper limit	Input lower limit
RATE ALARM TIME	32000	1
RATE ALARM UPR	32767	-32768
RATE ALARM LWR		

(11)Input signal error detection setting

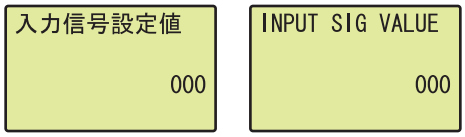
Select a detection method in the "INPUT SIG ERR" window.

"INPUT SIG ERR" window



↓

"INPUT SIG VALUE" window



1. **Use the ▲ and ▼ buttons to select the detection method from the following, and confirm with the OK button.**

- DISABLE
- UPR/LWR
- LWR
- UPR
- DISCONNECT

2. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor using the ▲ and ▼ buttons respectively. Confirm with the OK button.**

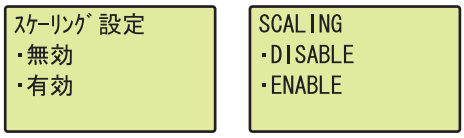
Table of input items

Input item	Input range	
	Input upper limit	Input lower limit
INPUT SIG VALUE	250	0

(12)Scaling setting

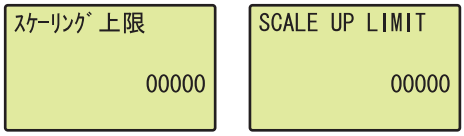
Select "DISABLE" or "ENABLE" in the "SCALING" window.

"SCALING" window



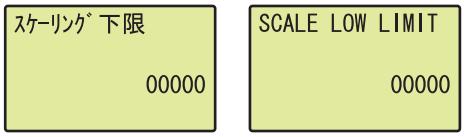
↓

"SCALE UP LIMIT" window



↓

"SCALE LOW LIMIT" window



1. **Use the ▲ and ▼ buttons to select "DISABLE" or "ENABLE", and confirm with the OK button. (When "ENABLE" is selected, follow the rest of the procedure.)**

2. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor using the ▲ and ▼ buttons respectively. Confirm with the OK button.**

3. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor using the ▲ and ▼ buttons respectively. Confirm with the OK button.**

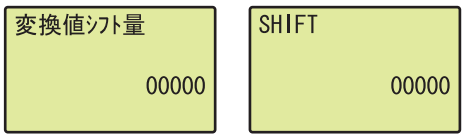
Table of input items

Input item	Input range	
	Input upper limit	Input lower limit
SCALE UP LIMIT	32000	-32000
SCALE LOW LIMIT		

(13)Shifting amount to conversion value

Set the shifting amount to conversion value in the "SHIFT" window.

"SHIFT" window



1. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor using the ▲ and ▼ buttons respectively. Confirm with the OK button.**

Table of input items

Input item	Input range	
	Input upper limit	Input lower limit
SHIFT	32767	-32768

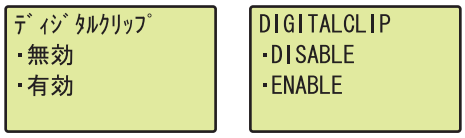
Point

"SHIFT" is reflected to the digital output value regardless of turning on then off Operating condition setting request (Y9). However, when "SHIFT" is set in a display unit, it is not reflected just after setting. As well as other functions of the display unit, turn the CPU module STOP → RUN → STOP → RUN to reflect the setting value.

(14)Digital clipping enable/disable setting

Select "DISABLE" or "ENABLE" in the "DIGITALCLIP" window.

"DIGITALCLIP" window



1. **Use the ▲ and ▼ buttons to select "DISABLE" or "ENABLE", and confirm with the OK button.**

9.4 Checking and Clearing Errors

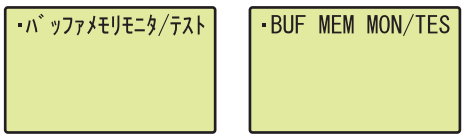
The errors that occurred in the A/D converter module can be checked from the display unit. In addition, the existing error can be cleared.

(1) Checking errors

The error that occurred in the A/D converter module can be checked by specifying Latest error code (Un\G19) from "BUF MEM MON/TES".

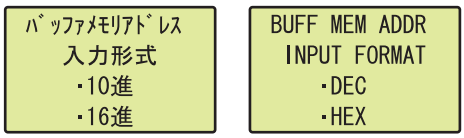
Ex. When an error occurs in the A/D converter module with a start I/O number of 10

"BUF MEM MON/TES" window



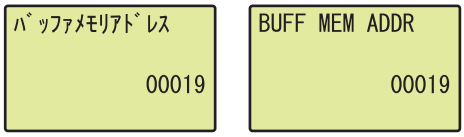
↓

"BUFF MEM ADDR INPUT FORMAT" window



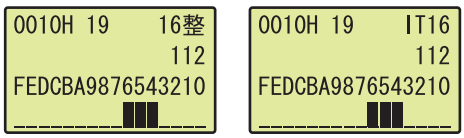
↓

"BUFF MEM ADDR" window



↓

"Buffer memory monitor" window



1. **Press the OK button.**

2. **Use the ▲ and ▼ buttons to select "DEC" for the input format of the buffer memory address, and confirm with the OK button.**

3. **Move the cursor using the ◀ and ▶ buttons, then increment or decrement the value at the cursor using the ▲ and ▼ buttons, and set the value to 19. Confirm with the OK button.**

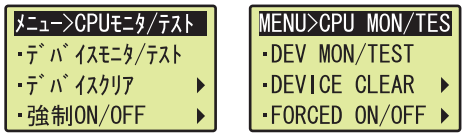
4. **The error that occurred can be checked in the "Buffer memory monitor" window.**

(2) Clearing errors

An error can be cleared by eliminating the cause of the error, and turning on then off Error clear request (YF) from "DEV MON/TEST".

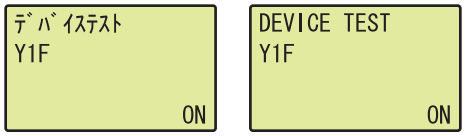
Ex. When an error occurs in the A/D converter module with a start I/O number of 10

"CPU MON/TES" window



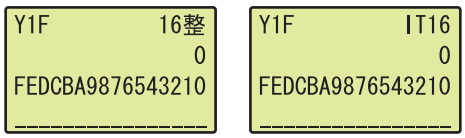
↓

"Device monitor" window

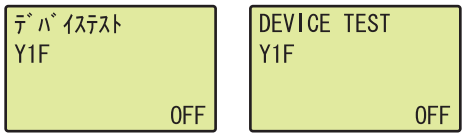


↓

"Device test" window



↓



1. **Use the ▲ and ▼ buttons to select "DEV MON/TEST", and confirm with the OK button.**

2. **Set the device to Y and press the OK button.**

3. **Use the ▲ and ▼ buttons to set the device to Y1F, and confirm with the OK button.**

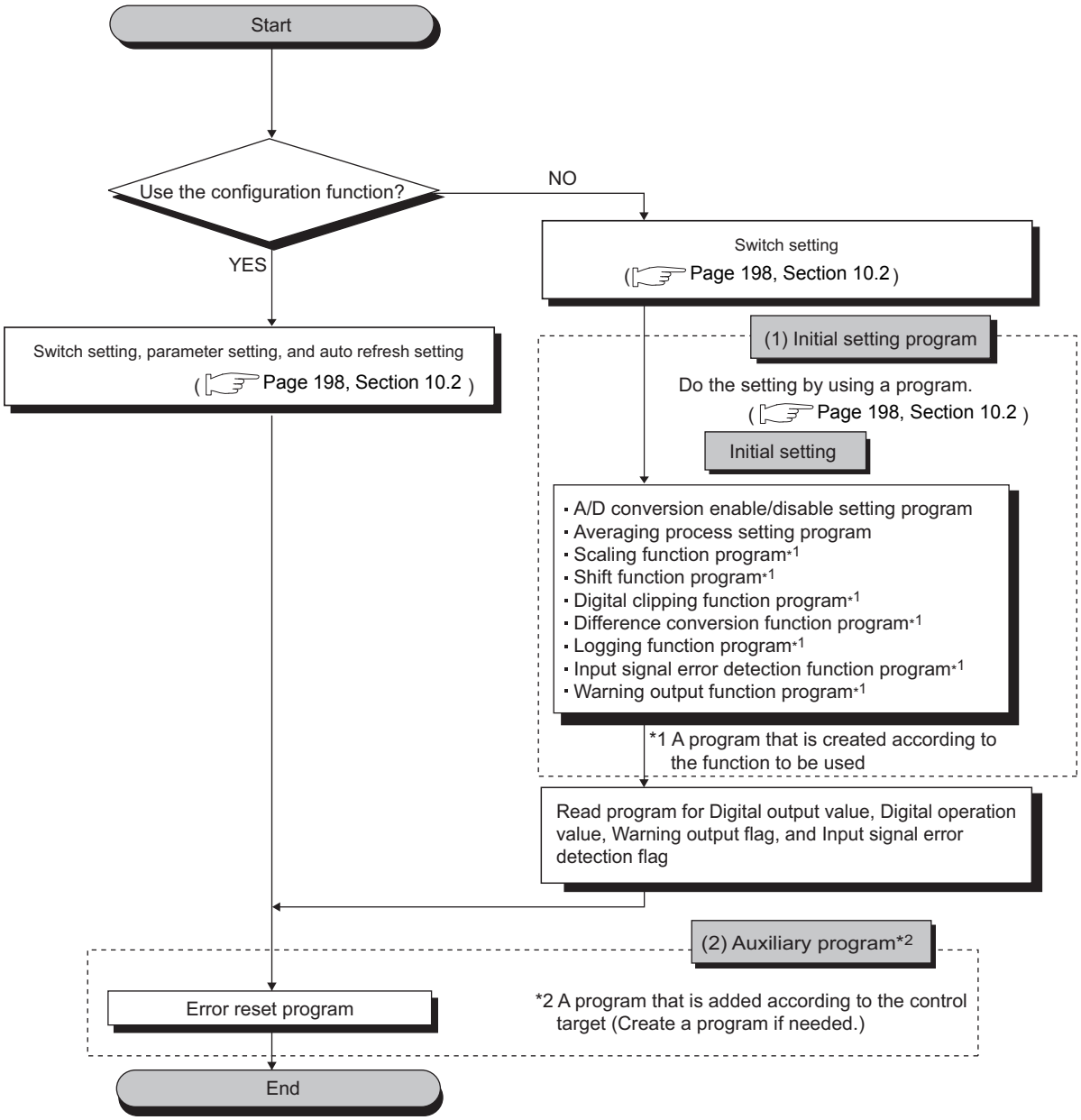
4. **Use the ▲ and ▼ buttons to switch on and off. Press the OK button to set the value set in the device test setting.**

CHAPTER 10 PROGRAMMING

This chapter describes the procedure for programming and the basic program of the A/D converter module.

10.1 Procedure for Programming

Create a program to execute A/D conversion according to the following procedure.

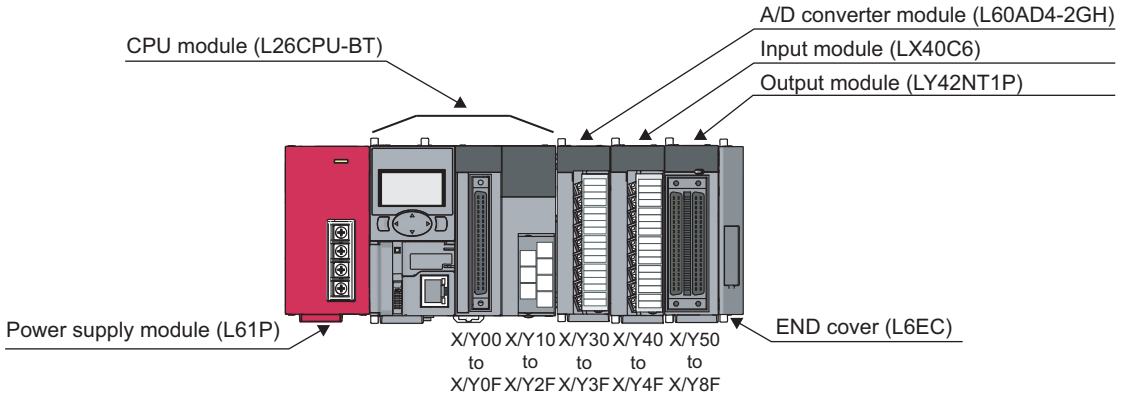

Start
Use the configuration function?
NO
YES
Switch setting
(Page 198, Section 10.2)
Switch setting, parameter setting, and auto refresh setting
(Page 198, Section 10.2)
(1) Initial setting program
Do the setting by using a program.
(Page 198, Section 10.2)
Initial setting
• A/D conversion enable/disable setting program
• Averaging process setting program
• Scaling function program*1
• Shift function program*1
• Digital clipping function program*1
• Difference conversion function program*1
• Logging function program*1
• Input signal error detection function program*1
• Warning output function program*1
*1 A program that is created according to the function to be used
Read program for Digital output value, Digital operation value, Warning output flag, and Input signal error detection flag
(2) Auxiliary program*2
*2 A program that is added according to the control target (Create a program if needed.)
Error reset program
End

10.2 When Using the Module in a Standard System Configuration

This section describes the system configuration of A/D converter module and a program example of operation condition.

(1) System configuration

The following figure shows an example of the system configuration when the module is used in a standard system configuration.



Point

If the L02CPU is used, assign I/O of the A/D converter module to X/Y30 to X/Y3F so that the I/O assignment of the A/D converter module is the same as that in the above system. Also, assign the I/O of LX40C6 to X/Y40 to X/Y4F and that of LY42NT1P to X/Y50 to X/Y8F.

(2) Programming condition

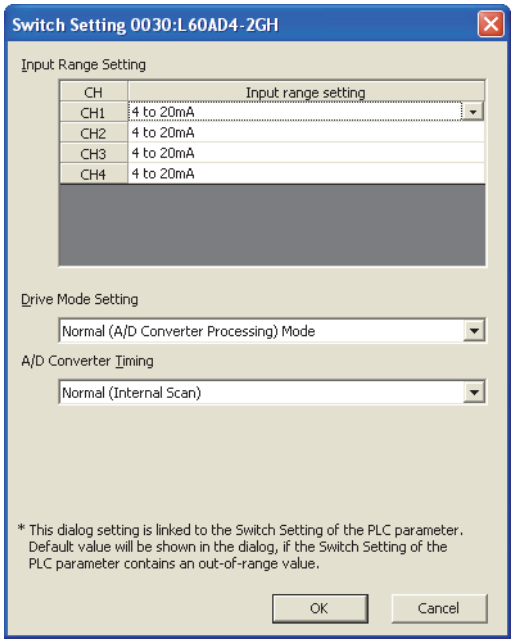
This program reads digital output values enabled for A/D conversion at CH1 to CH4 in the A/D converter module. (CH3 deals with the digital operation value.)

CH1 executes sampling processing, CH2 executes averaging processing every 50 times, CH3 converts analog values into digital values per 10 moving averages, and CH4 converts analog values into digital values through the time lag filter with a time constant of 8ms. If an error occurs in the module, an error code is indicated in BCD.

(3) Switch setting

Set the input range, the operation mode, and the A/D conversion timing.

Project window ⇨ [Intelligent Function Module] ⇨ [L60AD4-2GH] ⇨ [Switch Setting]



(4) Initial setting

(a) Channel setting

Item	Description			
	CH1	CH2	CH3	CH4
A/D conversion enable/disable setting	Enable	Enable	Enable	Enable
Averaging process setting	Sampling processing	Count average	Moving average	Primary delay filter
Time Average/Count Average/ Moving Average/Time lag filter constant	0	50 times	10 times	100 times
Warning output setting	Disable	Enable	Disable	Disable
Process alarm upper upper limit value	0	20000	0	0
Process alarm upper lower limit value	0	18000	0	0
Process alarm lower upper limit value	0	3000	0	0
Process alarm lower lower limit value	0	0	0	0
Rate alarm output setting	Disable	Disable	Disable	Enable
Rate alarm detection cycle setting value	0	0	0	320 times
Rate alarm upper limit value	0	0	0	20.0%
Rate alarm lower limit value	0	0	0	-20.0%
Input signal error detection setting	Upper and Lower Detection	Disable	Disable	Disable
Input signal error detection setting value	10.0%	5.0%	5.0%	5.0%
Scaling enable/disable setting	Disable	Disable	Enable	Disable
Scaling upper limit value	0	0	32000	0
Scaling lower limit value	0	0	0	0
Digital clipping function enable/ disable setting	Disable	Disable	Enable	Disable
Shifting amount to conversion value	0	0	10000	0

(b) Device for user

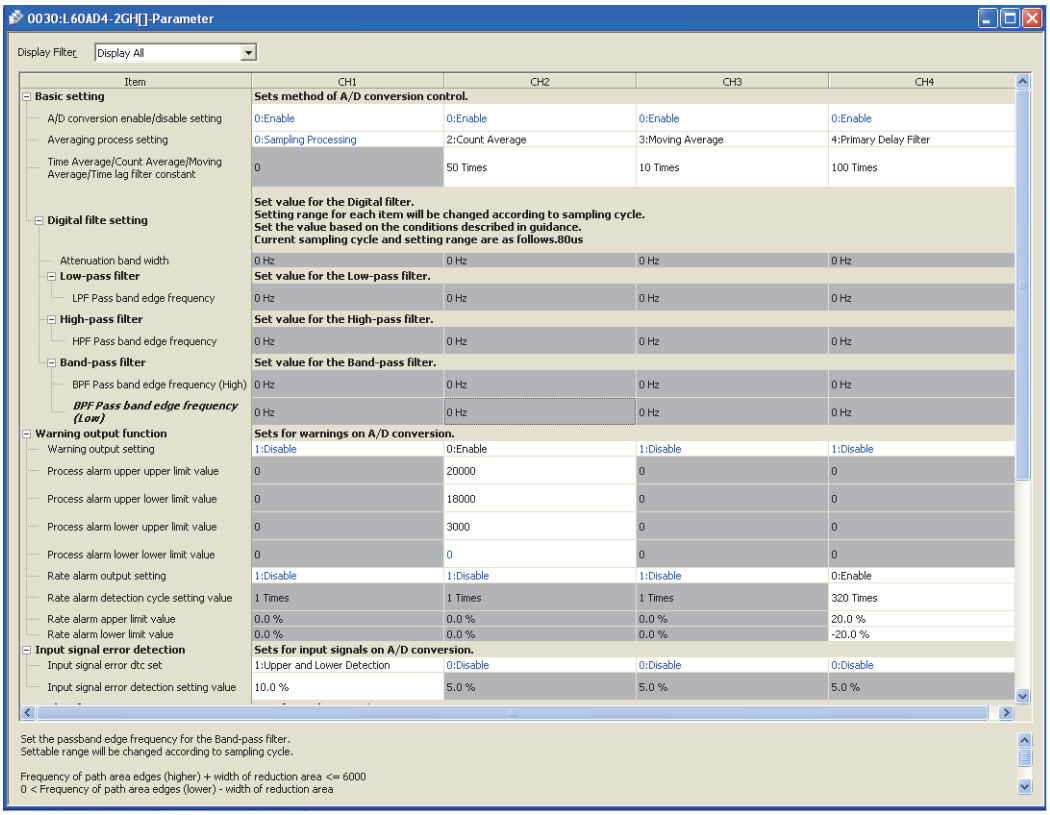
Device	Description	
D1 (D11)	CH1 Digital output value	
D2 (D12)	CH2 Digital output value	
D4 (D14)	CH4 Digital output value	
D8	Input signal error detection flag	
D10	Error code	
D18	Warning output flag (Process alarm)	
D19	Warning output flag (Rate alarm)	
D28 (D13)	CH3 Digital operation value	
M0	CH1 A/D conversion completed flag	
M1	CH2 A/D conversion completed flag	
M2	CH3 A/D conversion completed flag	
M3	CH4 A/D conversion completed flag	
M20 to M27	Warning output flag (Process alarm)	
M30 to M37	Warning output flag (Rate alarm)	
M50 to M53	Input signal error detection flag	
M100	Module READY checking flag	
X40	Digital output value read command input signal	LX40C6 (X40 to X4F)
X43	Input signal error detection reset signal	
X44	Error reset signal	
Y50 to Y5F	Error code notation (BCD 4 digits)	LY42NT1P (Y50 to Y5F)

(5) Program example when using the parameter of intelligent function module

(a) Parameter setting

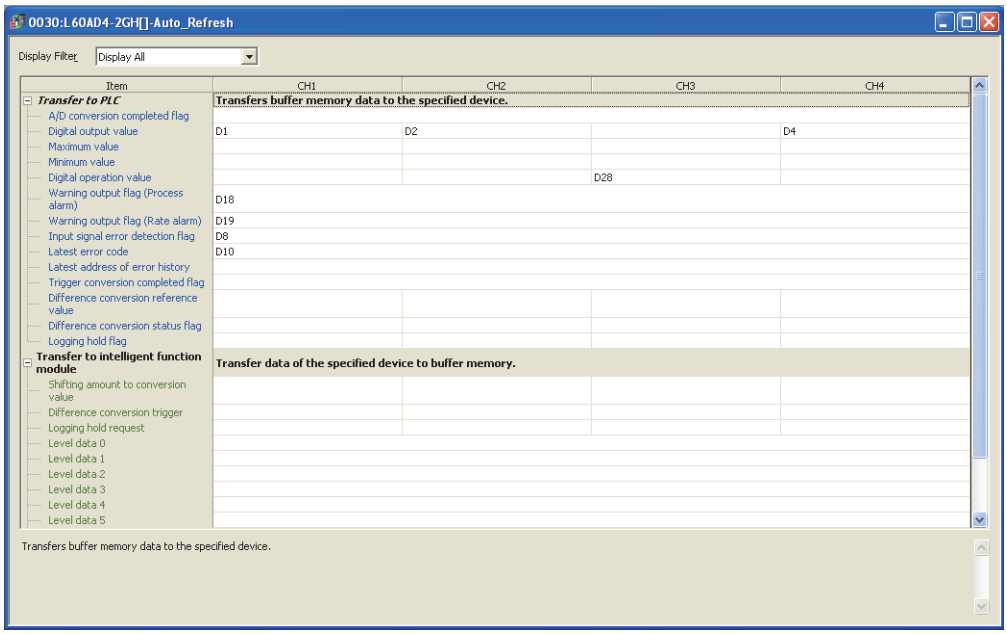
Set the contents of initial settings in the parameter.

Project window ⇨ [Intelligent Function Module] ⇨ [L60AD4-2GH] ⇨ [Parameter]



(b) Auto refresh setting

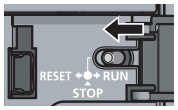
Project window ⇨ [Intelligent Function Module] ⇨ [L60AD4-2GH] ⇨ [Auto_Refresh]



(c) Writing parameter of intelligent function module

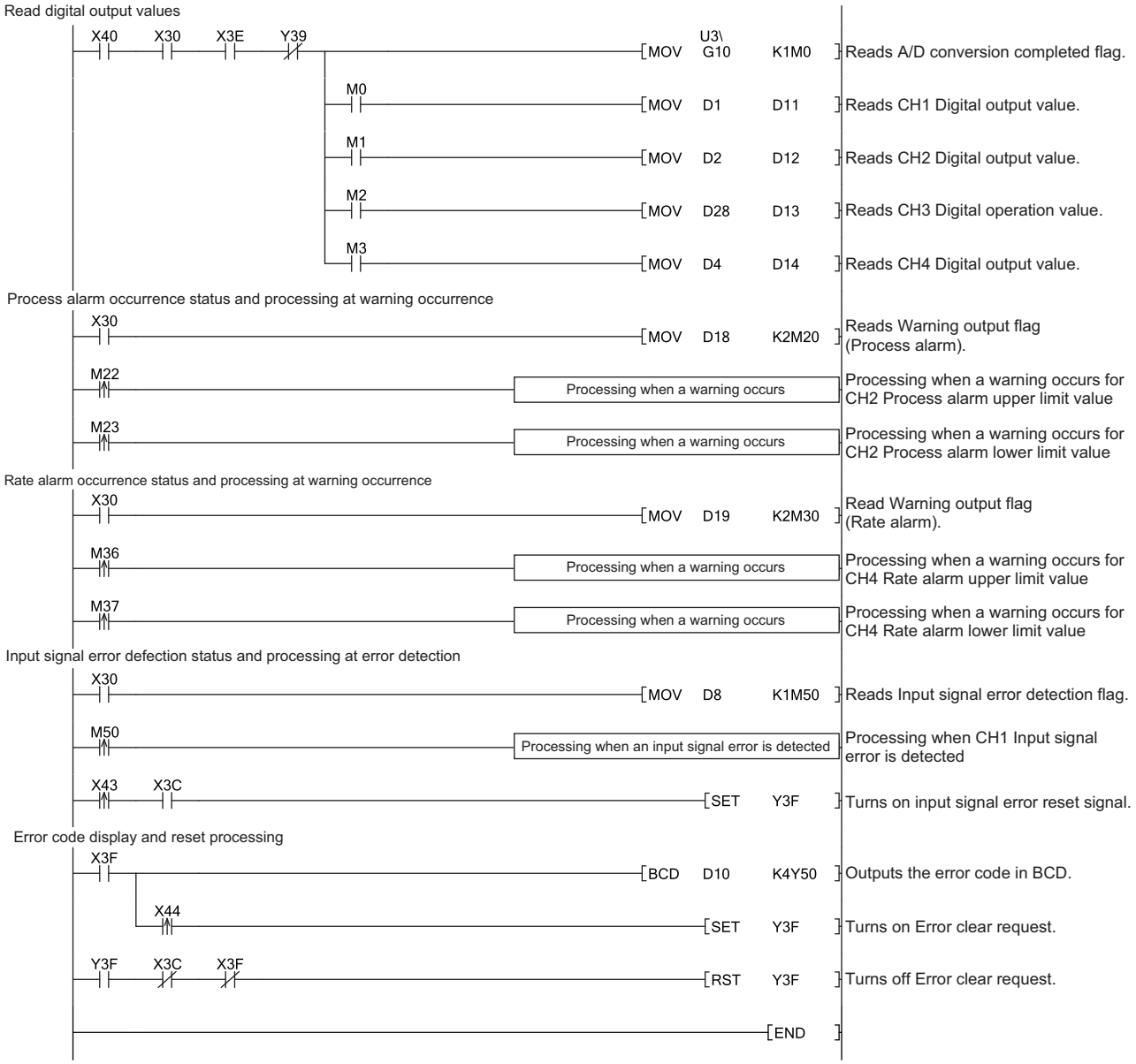
Write the set parameter to the CPU module and reset the CPU module, or power off then on the programmable controllers.

[Online] ⇨ [Write to PLC...]

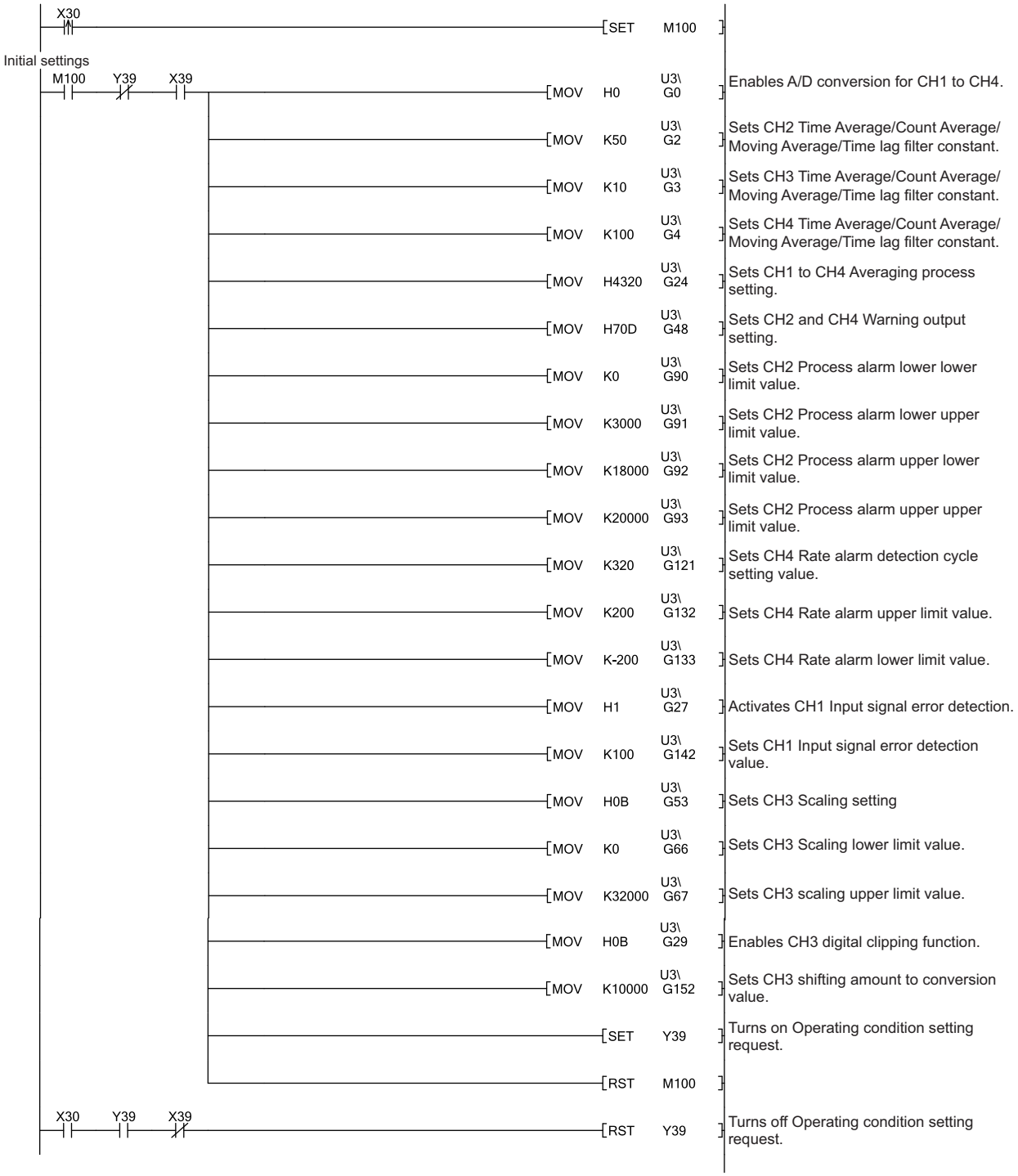


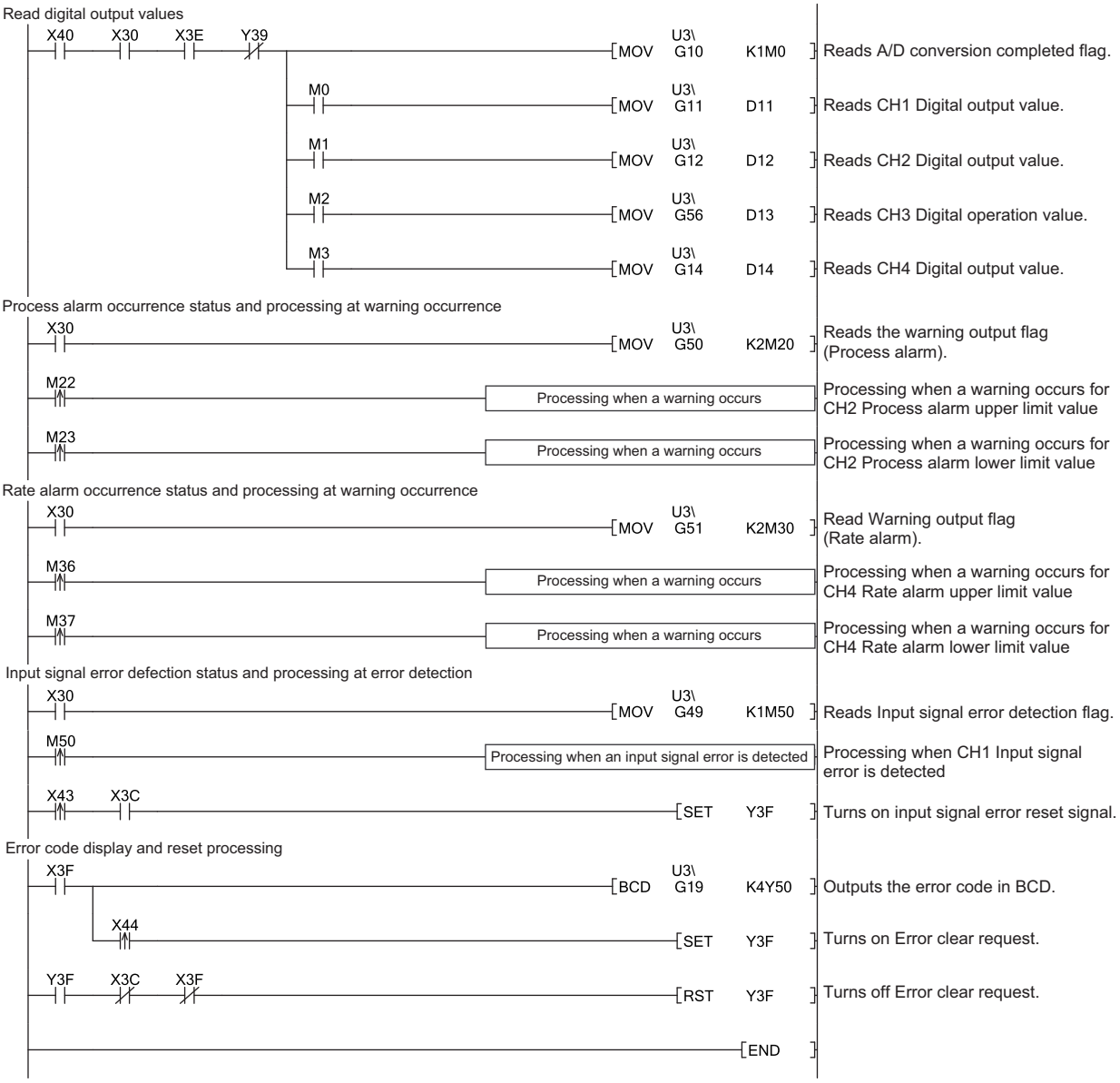
or Power OFF → ON

(d) Program example



(6) Program example when not using the parameter of intelligent function module


X30
SET M100
Initial settings
M100 Y39 X39
MOV H0 U3\G0 Enables A/D conversion for CH1 to CH4.
MOV K50 U3\G2 Sets CH2 Time Average/Count Average/ Moving Average/Time lag filter constant.
MOV K10 U3\G3 Sets CH3 Time Average/Count Average/ Moving Average/Time lag filter constant.
MOV K100 U3\G4 Sets CH4 Time Average/Count Average/ Moving Average/Time lag filter constant.
MOV H4320 U3\G24 Sets CH1 to CH4 Averaging process setting.
MOV H70D U3\G48 Sets CH2 and CH4 Warning output setting.
MOV K0 U3\G90 Sets CH2 Process alarm lower lower limit value.
MOV K3000 U3\G91 Sets CH2 Process alarm lower upper limit value.
MOV K18000 U3\G92 Sets CH2 Process alarm upper lower limit value.
MOV K20000 U3\G93 Sets CH2 Process alarm upper upper limit value.
MOV K320 U3\G121 Sets CH4 Rate alarm detection cycle setting value.
MOV K200 U3\G132 Sets CH4 Rate alarm upper limit value.
MOV K-200 U3\G133 Sets CH4 Rate alarm lower limit value.
MOV H1 U3\G27 Activates CH1 Input signal error detection.
MOV K100 U3\G142 Sets CH1 Input signal error detection value.
MOV H0B U3\G53 Sets CH3 Scaling setting
MOV K0 U3\G66 Sets CH3 Scaling lower limit value.
MOV K32000 U3\G67 Sets CH3 scaling upper limit value.
MOV H0B U3\G29 Enables CH3 digital clipping function.
MOV K10000 U3\G152 Sets CH3 shifting amount to conversion value.
SET Y39 Turns on Operating condition setting request.
RST M100
X30 Y39 X39
RST Y39 Turns off Operating condition setting request.


Read digital output values
X40
X30
X3E
Y39
MOV U3\G10 K1M0
Reads A/D conversion completed flag.
M0
MOV U3\G11 D11
Reads CH1 Digital output value.
M1
MOV U3\G12 D12
Reads CH2 Digital output value.
M2
MOV U3\G56 D13
Reads CH3 Digital operation value.
M3
MOV U3\G14 D14
Reads CH4 Digital output value.
Process alarm occurrence status and processing at warning occurrence
X30
MOV U3\G50 K2M20
Reads the warning output flag (Process alarm).
M22
Processing when a warning occurs
Processing when a warning occurs for CH2 Process alarm upper limit value
M23
Processing when a warning occurs
Processing when a warning occurs for CH2 Process alarm lower limit value
Rate alarm occurrence status and processing at warning occurrence
X30
MOV U3\G51 K2M30
Read Warning output flag (Rate alarm).
M36
Processing when a warning occurs
Processing when a warning occurs for CH4 Rate alarm upper limit value
M37
Processing when a warning occurs
Processing when a warning occurs for CH4 Rate alarm lower limit value
Input signal error defection status and processing at error detection
X30
MOV U3\G49 K1M50
Reads Input signal error detection flag.
M50
Processing when an input signal error is detected
Processing when CH1 Input signal error is detected
X43
X3C
SET Y3F
Turns on input signal error reset signal.
Error code display and reset processing
X3F
BCD U3\G19 K4Y50
Outputs the error code in BCD.
X44
SET Y3F
Turns on Error clear request.
Y3F
X3C
X3F
RST Y3F
Turns off Error clear request.
END

10.3 When an A/D Converter Module Is Connected to a Head Module

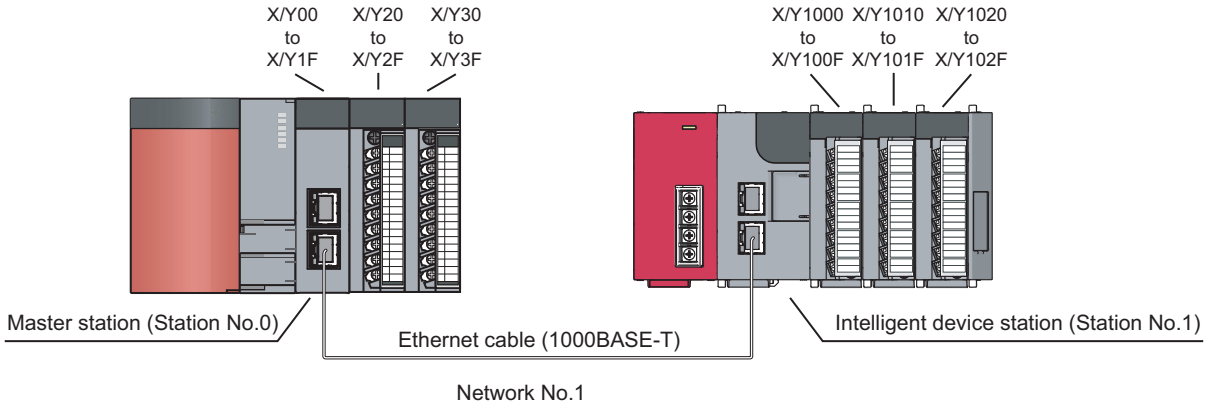
This section describes the system configuration of an A/D converter module and a program example of the operation condition.

(1) System configuration

The following figure shows an example of the system configuration when the A/D converter module is mounted to a head module.

Power supply module (Q62P)
CPU module (Q10UDHCPU)
Master/local module (QJ71GF11-T2)
Input module (QX10)
Output module (QY10)

Power supply module (L61P)
Head module (LJ72GF15-T2)
A/D converter module (L60AD4-2GH)
Input module (LX40C6)
Output module (LY10R2)
END cover (L6EC)



(2) Programming condition

This program reads digital output values enabled for A/D conversion at CH1 to CH4 in the A/D converter module. (CH3 deals with the digital operation value.)

CH1 executes sampling processing, CH2 executes averaging processing every 50 times, CH3 converts analog values into digital values per 10 moving averages, and CH4 converts analog values into digital values through the time lag filter with a time constant of 8ms. If an error occurs in the module, an error code is indicated in BCD.

(3) Initial setting

Item	Description			
	CH1	CH2	CH3	CH4
A/D conversion enable/disable setting	Enable	Enable	Enable	Enable
Averaging process setting	Sampling processing	Count average	Moving average	Primary delay filter
Time Average/Count Average/ Moving Average/Time lag filter constant	0	50 times	10 times	100 times
Warning output setting	Disable	Enable	Disable	Disable
Process alarm upper upper limit value	0	20000	0	0
Process alarm upper lower limit value	0	18000	0	0
Process alarm lower upper limit value	0	3000	0	0
Process alarm lower lower limit value	0	0	0	0
Rate alarm output setting	Disable	Disable	Disable	Enable
Rate alarm detection cycle setting value	0	0	0	320 times
Rate alarm upper limit value	0	0	0	20.0%
Rate alarm lower limit value	0	0	0	-20.0%
Input signal error detection setting	Upper and Lower Detection	Disable	Disable	Disable
Input signal error detection setting value	10.0%	5.0%	5.0%	5.0%
Scaling enable/disable setting	Disable	Disable	Enable	Disable
Scaling upper limit value	0	0	32000	0
Scaling lower limit value	0	0	0	0

(4) Device for user

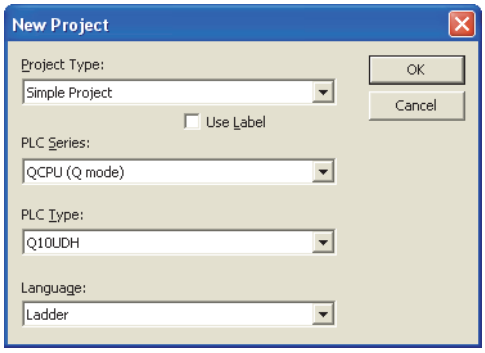
Device	Description	
W1000	A/D conversion completed flag	
W1001	CH1 Digital output value	
W1002	CH2 Digital output value	
W1004	CH4 Digital output value	
W1008	Input signal error detection flag	
W1010	Latest error code	
W1018	Warning output flag (Process alarm)	
W1019	Warning output flag (Rate alarm)	
W1028	CH3 Digital operation value	
M0	CH1 A/D conversion completed flag	
M1	CH2 A/D conversion completed flag	
M2	CH3 A/D conversion completed flag	
M3	CH4 A/D conversion completed flag	
M20 to M27	Warning output flag (Process alarm)	
M30 to M37	Warning output flag (Rate alarm)	
M50 to M53	Input signal error detection flag	
X20	Digital output value read command input signal	QX10 (X20 to X2F)
X23	Input signal error detection reset signal	
X24	Error reset signal	
Y30 to Y3F	Error code notation (BCD 4 digits)	QY10 (Y30 to Y3F)
SB49	Data link status (own station)	
SWB0.0	Data link status (each station) (station No.1)	
N0	Nesting (station No.1)	
M100	Flag for meeting the communication condition (station No.1)	

(5) Setting on the master station

1. Create a project on GX Works2.

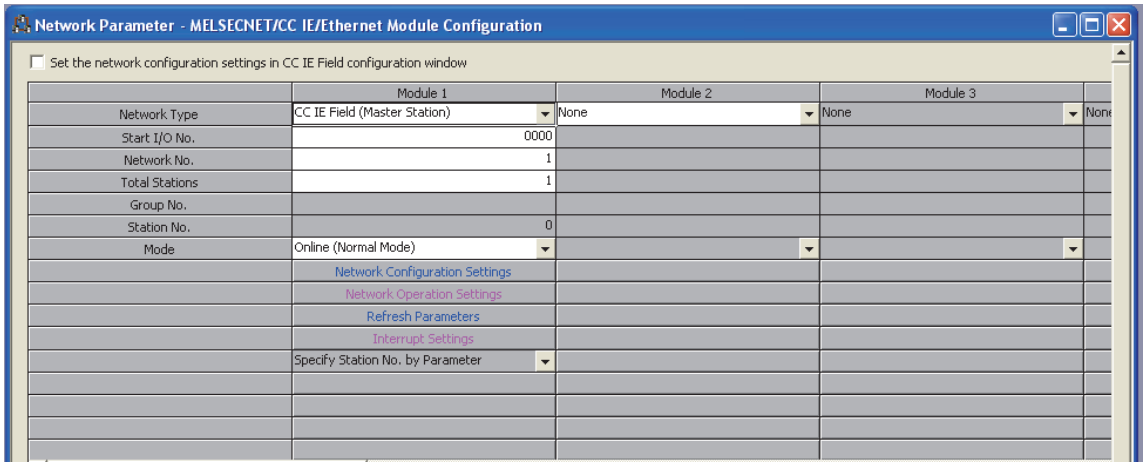
Select "QCPU (Q mode)" for "PLC Series" and select "Q10UDH" for "PLC Type."

[Project] ⇨ [New...]



2. Display the network parameter setting window and configure the setting as follows.

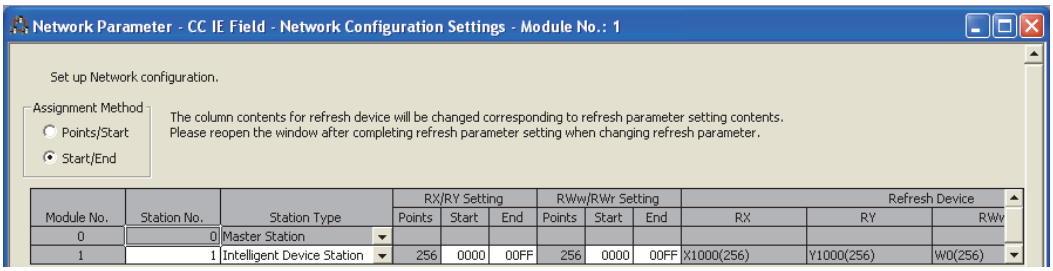
Project window ⇨ [Parameter] ⇨ [Network Parameter] ⇨ [Ethernet/CC IE/MELSECNET]



3. Display the Network Configuration Settings window and configure the setting as follows.

Project window ⇨ [Parameter] ⇨ [Network Parameter] ⇨ [Ethernet/CC IE/MELSECNET]

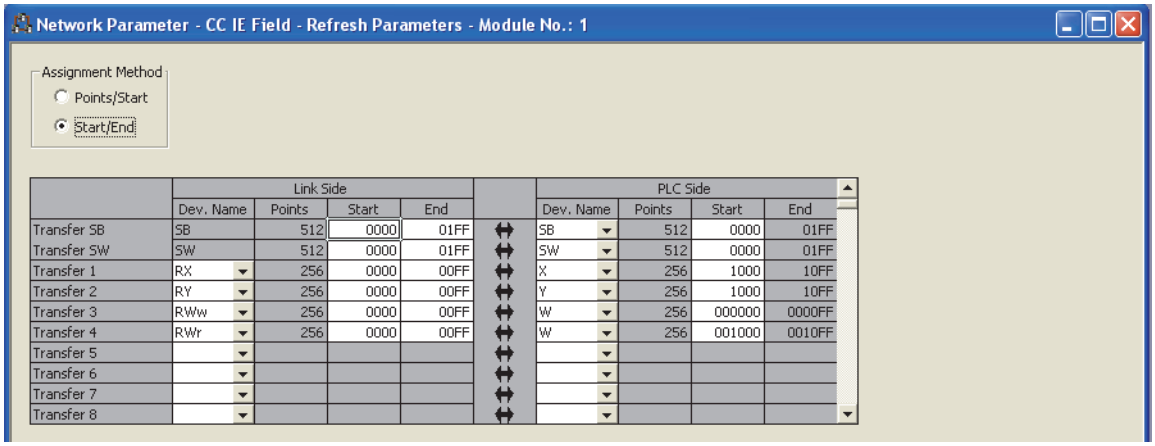
⇨ Network Configuration Settings button


Network Parameter - CC IE Field - Network Configuration Settings - Module No.: 1
Set up Network configuration.
Assignment Method
Points/Start
Start/End
The column contents for refresh device will be changed corresponding to refresh parameter setting contents.
Please reopen the window after completing refresh parameter setting when changing refresh parameter.
Module No. | Station No. | Station Type | RX/RY Setting Points | Start | End | RWw/RWr Setting Points | Start | End | Refresh Device RX | RY | RWw
0 | 0 | Master Station
1 | 1 | Intelligent Device Station | 256 | 0000 | 00FF | 256 | 0000 | 00FF | X1000(256) | Y1000(256) | W0(256)

4. Display the Refresh Parameters window and configure the setting as follows.

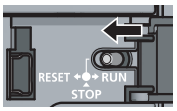
Project window ⇨ [Parameter] ⇨ [Network Parameter] ⇨ [Ethernet/CC IE/MELSECNET]

⇨ Refresh Parameters button


Network Parameter - CC IE Field - Refresh Parameters - Module No.: 1
Assignment Method
Points/Start
Start/End
Link Side: Dev. Name | Points | Start | End
PLC Side: Dev. Name | Points | Start | End
Transfer SB | SB | 512 | 0000 | 01FF | SB | 512 | 0000 | 01FF
Transfer SW | SW | 512 | 0000 | 01FF | SW | 512 | 0000 | 01FF
Transfer 1 | RX | 256 | 0000 | 00FF | X | 256 | 1000 | 10FF
Transfer 2 | RY | 256 | 0000 | 00FF | Y | 256 | 1000 | 10FF
Transfer 3 | RWw | 256 | 0000 | 00FF | W | 256 | 000000 | 0000FF
Transfer 4 | RWr | 256 | 0000 | 00FF | W | 256 | 001000 | 0010FF
Transfer 5
Transfer 6
Transfer 7
Transfer 8

5. Write the set parameter to the CPU module of the master station and reset the CPU module, or power off then on the programmable controllers.

[Online] ⇨ [Write to PLC...]



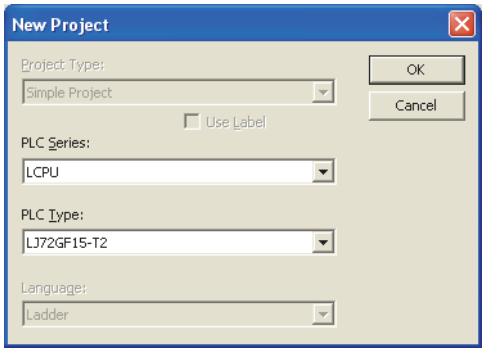
or Power OFF → ON

(6) Setting on the intelligent device station

1. Create a project on GX Works2.

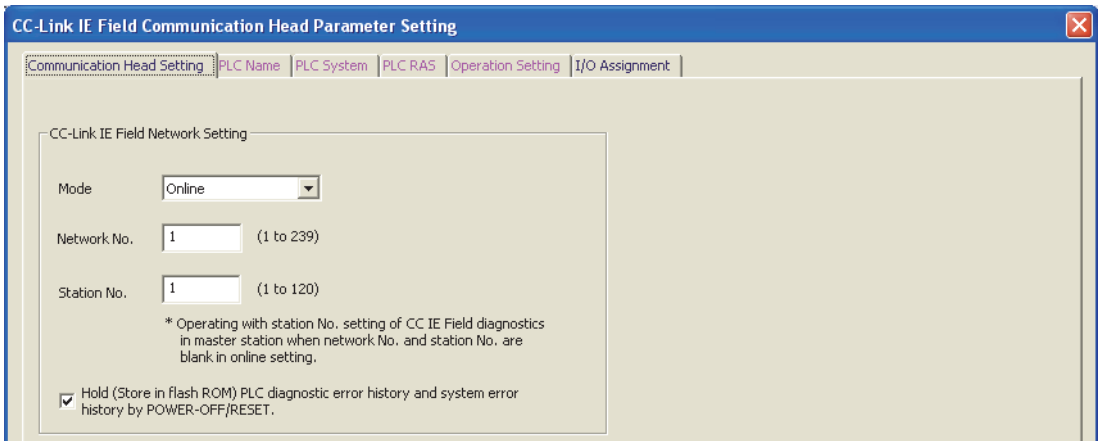
Select "LCPU" for "PLC Series" and select "LJ72GF15-T2" for "PLC Type."

[Project] ⇨ [New...]



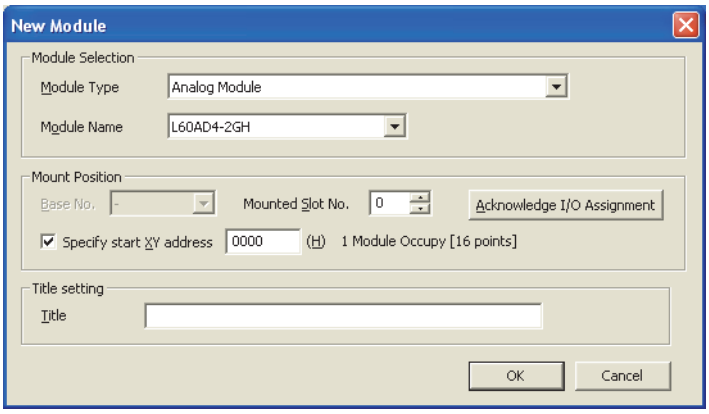
2. Display the PLC Parameter window and configure the setting as follows.

Project window ⇨ [Parameter] ⇨ [PLC Parameter] ⇨ "Communication Head Setting"


CC-Link IE Field Communication Head Parameter Setting
Communication Head Setting
PLC Name
PLC System
PLC RAS
Operation Setting
I/O Assignment
CC-Link IE Field Network Setting
Mode
Online
Network No.
1
(1 to 239)
Station No.
1
(1 to 120)
* Operating with station No. setting of CC IE Field diagnostics in master station when network No. and station No. are blank in online setting.
Hold (Store in flash ROM) PLC diagnostic error history and system error history by POWER-OFF/RESET.

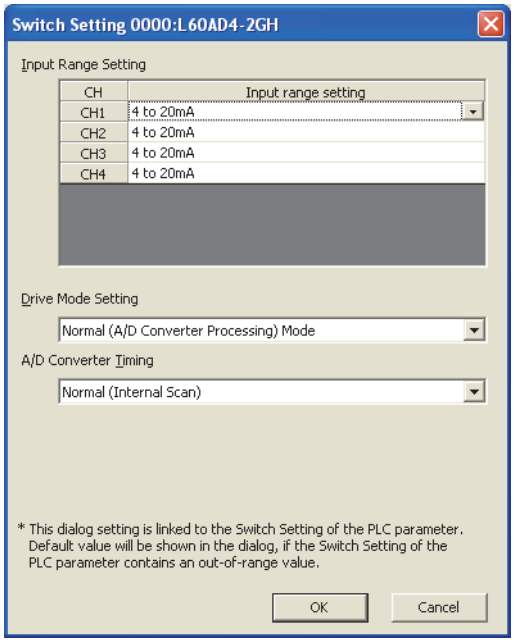
3. Add the A/D converter module (L60AD4-2GH) to the GX Works2 project.

Project window ⇨ [Intelligent Function Module] ⇨ Right-click ⇨ [New Module]



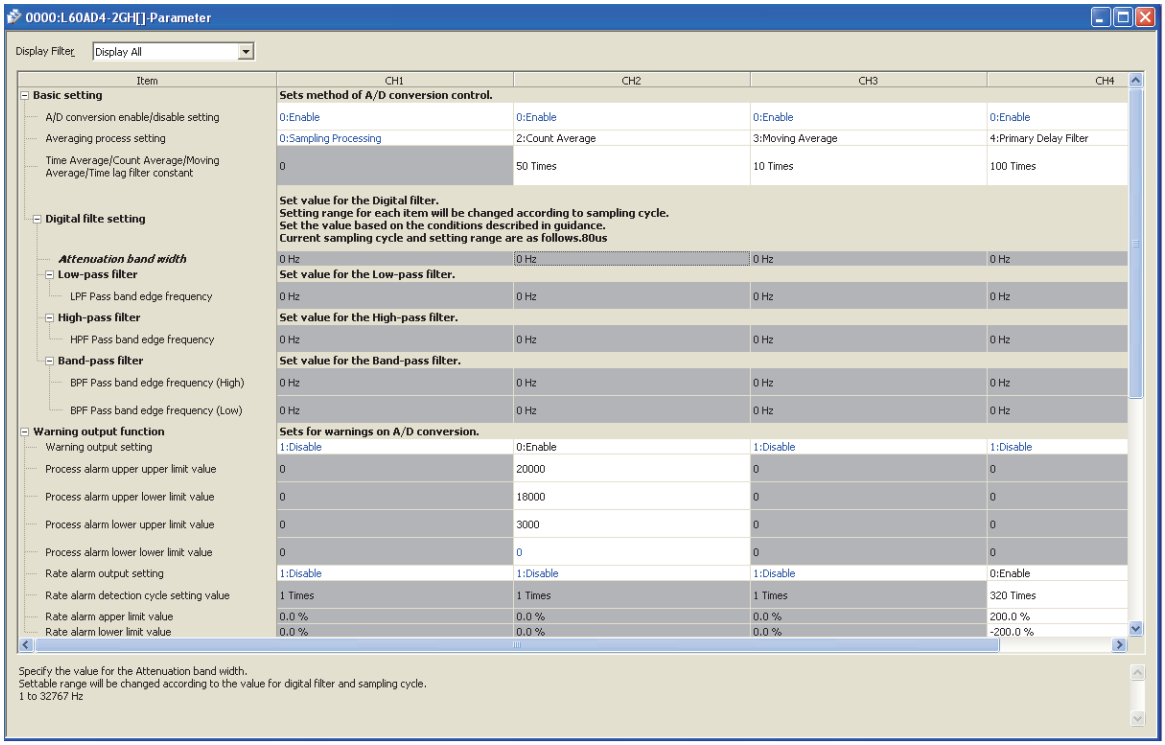
4. Display the Switch Setting window for the A/D converter module (L60AD4-2GH) and configure the setting as follows.

Project window ⇨ [Intelligent Function Module] ⇨ [L60AD4-2GH] ⇨ [Switch Setting]


Switch Setting 0000:L60AD4-2GH
Input Range Setting
CH
Input range setting
CH1
4 to 20mA
CH2
4 to 20mA
CH3
4 to 20mA
CH4
4 to 20mA
Drive Mode Setting
Normal (A/D Converter Processing) Mode
A/D Converter Timing
Normal (Internal Scan)
* This dialog setting is linked to the Switch Setting of the PLC parameter. Default value will be shown in the dialog, if the Switch Setting of the PLC parameter contains an out-of-range value.
OK
Cancel

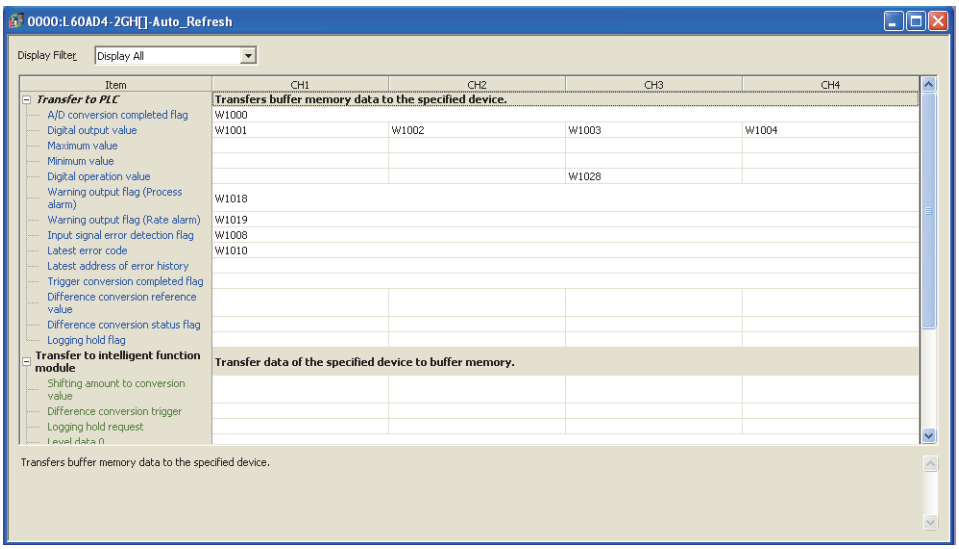
5. Display the initial setting window for the A/D converter module (L60AD4-2GH) and configure the setting as follows.

Project window ⇨ [Intelligent Function Module] ⇨ [L60AD4-2GH] ⇨ [Parameter]



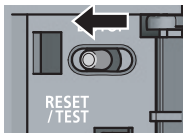
6. Display the Auto Refresh setting window for the A/D converter module (L60AD4-2GH) and configure the setting as follows.

Project window ⇨ [Intelligent Function Module] ⇨ [L60AD4-2GH] ⇨ [Auto_Refresh]



7. Write the set parameter to the head module and reset the head module, or power off then on the programmable controllers.

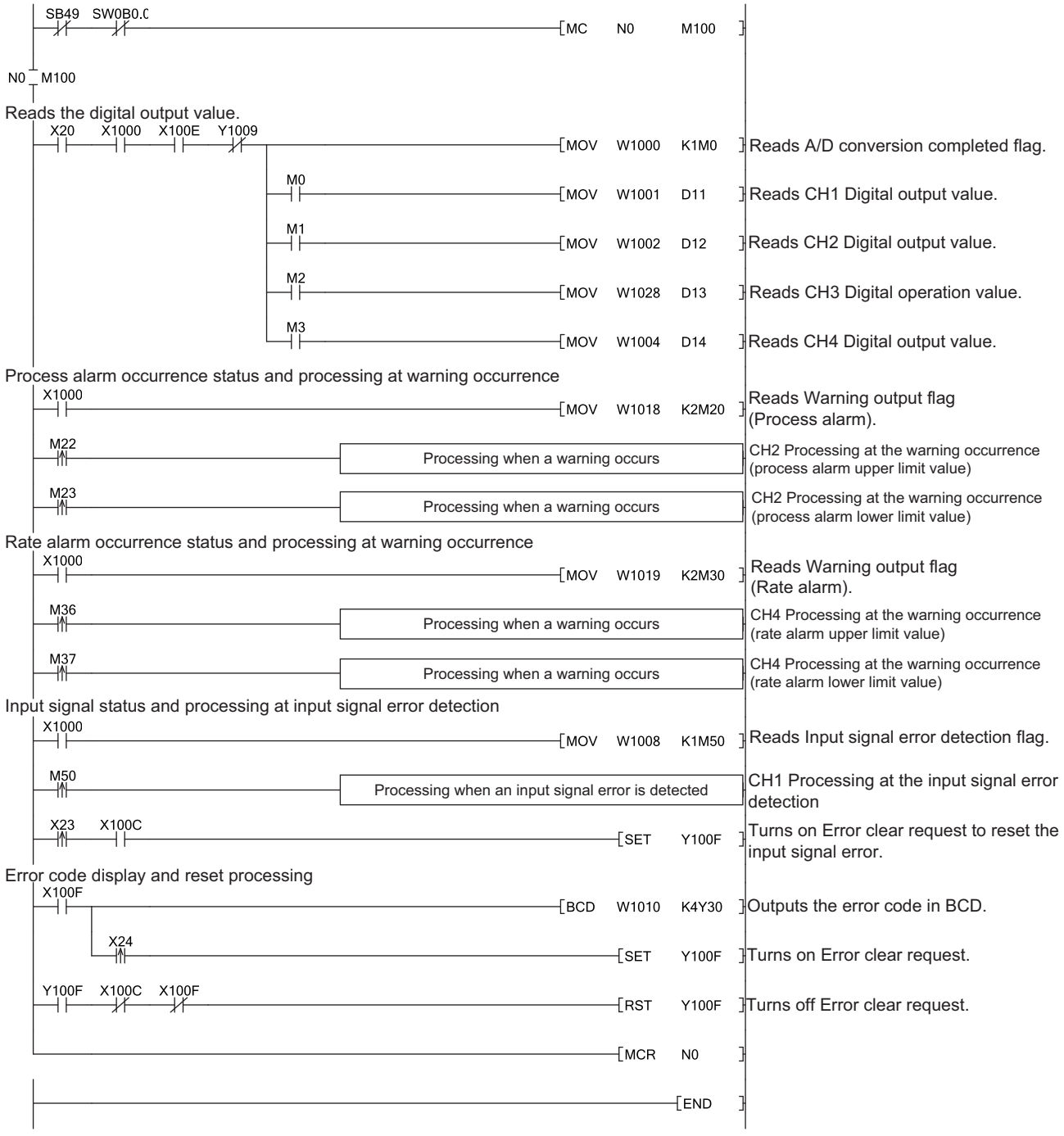
[Online] ⇨ [Write to PLC...]



or Power OFF→ON

(7) Program example

The following shows a program example. The program can be written to the CPU module of the master station.


SB49
SW0B0.0
MC N0 M100
N0 M100
Reads the digital output value.
X20 X1000 X100E Y1009
MOV W1000 K1M0
Reads A/D conversion completed flag.
M0
MOV W1001 D11
Reads CH1 Digital output value.
M1
MOV W1002 D12
Reads CH2 Digital output value.
M2
MOV W1028 D13
Reads CH3 Digital operation value.
M3
MOV W1004 D14
Reads CH4 Digital output value.
Process alarm occurrence status and processing at warning occurrence
X1000
MOV W1018 K2M20
Reads Warning output flag (Process alarm).
M22
Processing when a warning occurs
CH2 Processing at the warning occurrence (process alarm upper limit value)
M23
Processing when a warning occurs
CH2 Processing at the warning occurrence (process alarm lower limit value)
Rate alarm occurrence status and processing at warning occurrence
X1000
MOV W1019 K2M30
Reads Warning output flag (Rate alarm).
M36
Processing when a warning occurs
CH4 Processing at the warning occurrence (rate alarm upper limit value)
M37
Processing when a warning occurs
CH4 Processing at the warning occurrence (rate alarm lower limit value)
Input signal status and processing at input signal error detection
X1000
MOV W1008 K1M50
Reads Input signal error detection flag.
M50
Processing when an input signal error is detected
CH1 Processing at the input signal error detection
X23 X100C
SET Y100F
Turns on Error clear request to reset the input signal error.
Error code display and reset processing
X100F
BCD W1010 K4Y30
Outputs the error code in BCD.
X24
SET Y100F
Turns on Error clear request.
Y100F X100C X100F
RST Y100F
Turns off Error clear request.
MCR N0
END

CHAPTER 11 TROUBLESHOOTING

This chapter describes errors that may occur in the use of the A/D converter module and those troubleshooting.

(1) Checking for the error codes and alarm codes

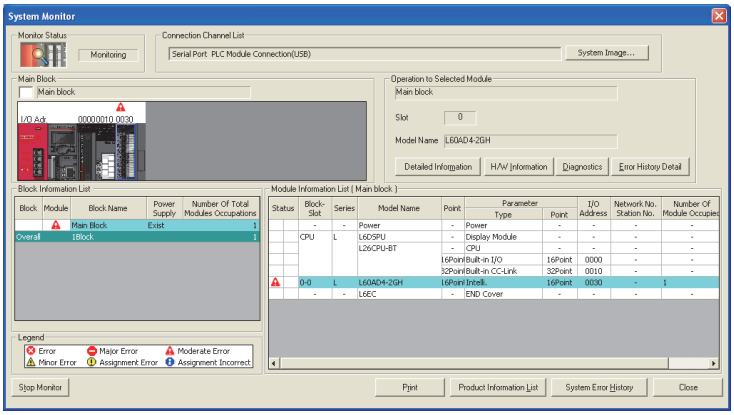
Errors and alarms that occurred in the A/D converter module can be checked by any of the following methods: Choose the checking methods for the purpose and application.

- Checking on the Module Detailed Information (☞Page 218, Section 11.1)
- Checking by Latest Error Code (Un\G19) (☞Page 219, Section 11.2)
- Checking on the module error collection function (☞Page 220, Section 11.3)
- Checking by a display unit (☞Page 195, Section 9.4)

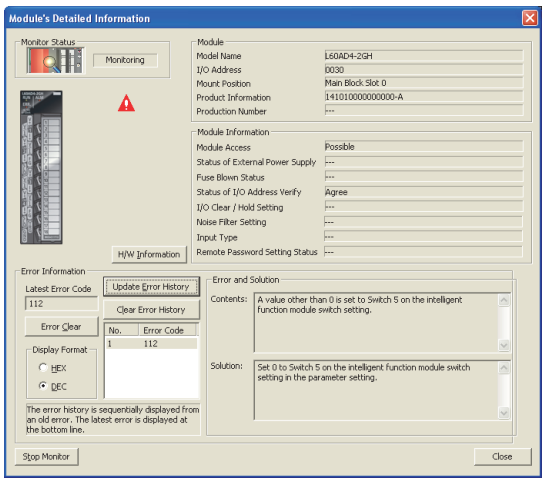
11.1 Checking on the Module Detailed Information

The following describes how to check the errors on the module detailed information.

[Diagnostics] ⇨ [System Monitor...]



↓



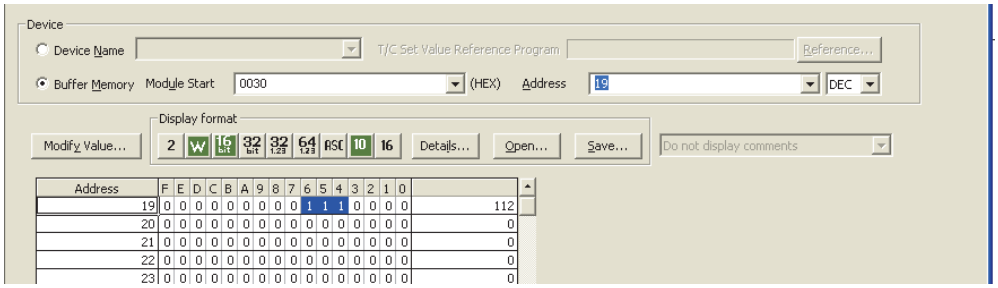
1. **Select the A/D converter module in "Main Block" and click the Detailed Information button.**

2. **"Module's Detailed Information" of the A/D converter module is displayed.**

11.2 Checking by Latest Error Code (Un\G19)

The following describes how to check the error codes and alarm codes in Latest error code (Un\G19).

[Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch]


Device
Device Name
T/C Set Value Reference Program
Reference...
Buffer Memory
Module Start
0030
(HEX)
Address
19
DEC
Display format
Modify Value...
Details...
Open...
Save...
Do not display comments
Address
F E D C B A 9 8 7 6 5 4 3 2 1 0
19 0 0 0 0 0 0 0 0 0 1 1 1 0 0 0 0 112
20 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
21 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
22 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
23 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

Point

When multiple errors or alarms occur, the latest error code or alarm code which is recognized by the A/D converter module is stored in Latest error code (Un\G19).

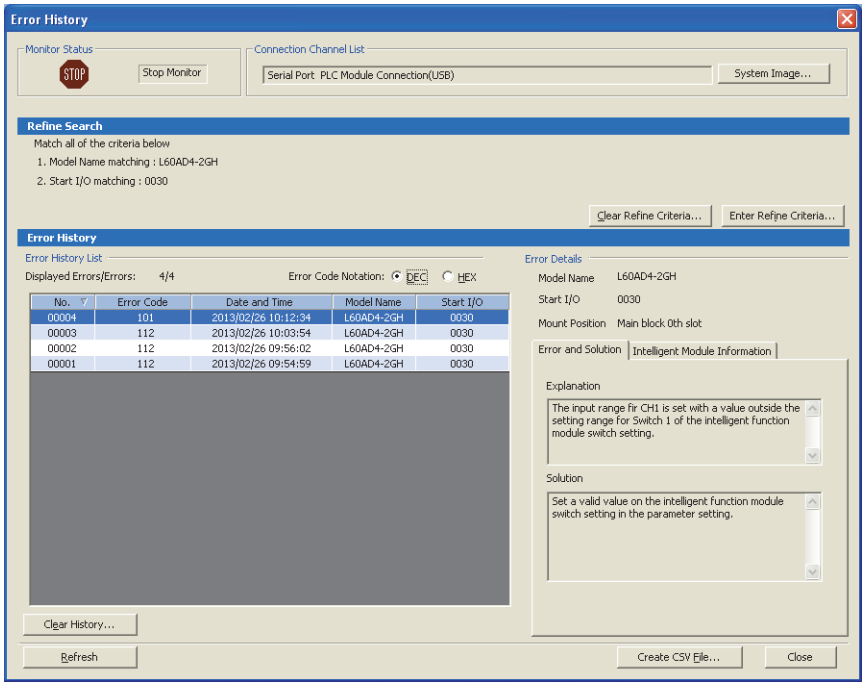
11.3 Checking on the Module Error Collection Function

Using the module error collection function stores the errors that occurred in the A/D converter module to the CPU module. Once being stored, the errors remain even after the CPU module is powered off or reset.

(1) How to check the errors by module error collection function

To check the errors of the A/D converter module collected by the CPU module, open the "Error History" window.

[Diagnostics] ⇨ [System Monitor] ⇨ click the Error History Detail button


Error History
Monitor Status
STOP
Stop Monitor
Connection Channel List
Serial Port PLC Module Connection(USB)
System Image...
Refine Search
Match all of the criteria below
1. Model Name matching : L60AD4-2GH
2. Start I/O matching : 0030
Clear Refine Criteria...
Enter Refine Criteria...
Error History
Error History List
Displayed Errors/Errors: 4/4
Error Code Notation: DEC HEX
No. Error Code Date and Time Model Name Start I/O
00004 101 2013/02/26 10:12:34 L60AD4-2GH 0030
00003 112 2013/02/26 10:03:54 L60AD4-2GH 0030
00002 112 2013/02/26 09:56:02 L60AD4-2GH 0030
00001 112 2013/02/26 09:54:59 L60AD4-2GH 0030
Error Details
Model Name L60AD4-2GH
Start I/O 0030
Mount Position Main block 0th slot
Error and Solution
Intelligent Module Information
Explanation
The input range fir CH1 is set with a value outside the setting range for Switch 1 of the intelligent function module switch setting.
Solution
Set a valid value on the intelligent function module switch setting in the parameter setting.
Clear History...
Refresh
Create CSV File...
Close

(2) Errors to be collected

The A/D converter module reports the errors and alarms described in the following section to the CPU module:

- Error Code List (Page 221, Section 11.4)
- Alarm Code List (Page 226, Section 11.5)

11.4 Error Code List

If the following errors occur on the A/D converter module while data is written to or read from the CPU module, the corresponding error code below is stored in Latest error code (Un\G19).
The error is reported to the CPU module also.

Error code (decimal)	Description and cause of error	Action
10□	The input range is set with a value outside the setting range for Switch 1 of the intelligent function module switch setting. The channel with the invalid setting fits in □.	Set a valid value on the intelligent function module switch setting in the parameter setting.
111	A hardware failure has occurred on the module.	Power off and on the module. If the error occurs again, a failure might have occurred on the module. Please consult a local Mitsubishi representative.
112	A value other than 0 is set to Switch 5 on the intelligent function module switch setting.	Set 0 to Switch 5 on the intelligent function module switch setting in the parameter setting.
113*1	The data in the flash memory has a problem.	Check the digital output value. If there is a problem of the digital output value, please consult a local Mitsubishi representative.
120*1	An invalid value is set to the offset/gain setting. The channel where the error has occurred cannot be identified.	Start over the offset/gain setting of all channels where the user range setting is used. If the error occurs again, a failure might have occurred on the module. Please consult a local Mitsubishi representative.
12□*1	An invalid value is set to the offset/gain setting. The channel where the error has occurred fits in □.	Start over the offset/gain setting of the channel where the error has occurred. If the error occurs again, a failure might have occurred on the module. Please consult a local Mitsubishi representative.
161*1*2	The G(P).OGSTOR instruction was executed in the offset/gain setting mode.	Do not execute the G(P).OGSTOR instruction in the offset/gain setting mode.
162*1	• The G(P).OGSTOR instruction has been consecutively executed. • For the offset/gain setting, a setting value has been consecutively written to the flash memory more than 25 times.	• Execute the G(P).OGSTOR instruction only once per module. • Write the setting value into the flash memory only once for each offset/gain setting.
163*1	• The G(P).OGSTOR instruction has been executed on a module different from the one on which the G(P).OGLOAD instruction was executed. • The G(P).OGSTOR instruction has been executed ahead of the G(P).OGLOAD instruction.	• Execute the G(P).OGLOAD and G(P).OGSTOR instructions to the same module. • After executing the G(P).OGLOAD instruction on the module from where data is restored, execute the G(P).OGSTOR instruction on the module to where the data is restored.
170*1	The offset/gain setting was configured exceeding the maximum number of times.	No more offset/gain setting is reflected on the operation successfully.
171*1	When Channel change request (YB) turns on in the offset/gain setting mode, a value other than User range setting (uni-polar: current) or User range setting (bi-polar: voltage) is set in the input range setting.	Set User range setting (uni-polar: current) or User range setting (bi-polar: voltage) in the input range setting.
20□*1	The averaging time value set in CH□ Time Average/Count Average/Moving Average/Time lag filter constant (Un\G1 to Un\G4) is outside the range of 2 to 5000ms. The channel where the error has occurred fits in □.	Set the averaging time to a value within the range of 2 to 5000ms.

Error code (decimal)	Description and cause of error	Action
30□[*1]	The averaging count value set in CH□ Time Average/Count Average/Moving Average/Time lag filter constant (Un\G1 to Un\G4) is outside the range of 4 to 65000. The channel where the error has occurred fits in □.	Set the averaging count to a value in the range of 4 to 65000.
31□[*1]	The moving average count value set in CH□ Time Average/Count Average/Moving Average/Time lag filter constant (Un\G1 to Un\G4) is outside the range of 2 to 1000. The channel where the error has occurred fits in □.	Set the moving average count to a value in the range of 2 to 1000.
32□[*1]	The time lag filter constant value set in CH□ Time Average/Count Average/Moving Average/Time lag filter constant (Un\G1 to Un\G4) is outside the range of 1 to 500. The channel where the error has occurred fits in □.	Set the time lag filter constant to a value within the range of 1 to 500.
37□[*1]	The value set in CH□ Difference conversion trigger (Un\G172 to Un\G175) is other than 0 and 1. The channel where the error has occurred fits in □.	Set the value in CH□ Difference conversion trigger (Un\G172 to Un\G175) to No request (0) or Trigger request (1).
40□[*1]	When the user range is set or restored, values are as follows: Offset value ≥ Gain value The channel where the error has occurred fits in □.	Set values so that they meet the following condition: Offset value < Gain value
500[*1]	When the offset/gain setting is configured, channels or 0s are set simultaneously in both Offset/gain setting mode Offset specification (Un\G22) and Offset/gain setting mode Gain specification (Un\G23).	Correct the setting in Offset/gain setting mode Offset specification (Un\G22) and/or Offset/gain setting mode Gain specification (Un\G23).
6△□[*1]	The settings in CH1 Process alarm lower lower limit value (Un\G86) to CH4 Process alarm upper upper limit value (Un\G101) are invalid. The channel with the invalid setting fits in □. A value fits in △ indicates that the alarm status is as follows: 2: Process alarm lower lower limit value > Process alarm lower upper limit value 3: Process alarm lower upper limit value > Process alarm upper lower limit value 4: Process alarm upper lower limit value > Process alarm upper upper limit value	Correct the settings in CH1 Process alarm lower lower limit value (Un\G86) to CH4 Process alarm upper upper limit value (Un\G101).
70□[*1]	CH1 Rate alarm upper limit value (Un\G126) to CH4 Rate alarm lower limit value (Un\G133) are set as follows: Rate alarm lower limit value ≥ Rate alarm upper limit value The channel where the error has occurred fits in □.	Set CH1 Rate alarm upper limit value (Un\G126) to CH4 Rate alarm lower limit value (Un\G133) so that they meet the following condition: Rate alarm lower limit value < Rate alarm upper limit value
71□[*1]	The value set in CH□ Rate alarm detection cycle setting value (Un\G118 to Un\G121) is outside the range of 1 to 32000. The channel where the error has occurred fits in □.	Set a value within the range of 1 to 32000 in CH□ Rate alarm detection cycle setting value (Un\G118 to Un\G121).
80□[*1]	The value set in CH□ Input signal error detection setting value (Un\G142 to Un\G145) is outside the range of 0 to 250. The channel where the error has occurred fits in □.	Set a value within the range of 0 to 250 in CH□ Input signal error detection setting value (Un\G142 to Un\G145).
81□[*1]	The value set in Input signal error detection setting (Un\G27) is outside the range of 0 to 4. The channel where the error has occurred fits in □.	Set one of the following values in Input signal error detection setting (Un\G27) for the channel where the error has occurred. • Disable (0) • Upper/lower limit detection (1) • Lower limit detection (2) • Upper limit detection (3) • Disconnection detection (4)

Error code (decimal)	Description and cause of error	Action
82□[*1]	A value set in Input signal error detection setting (Un\G27) is Disconnection detection (4), besides the set input range for the same channel is other than the following. • 4 to 20mA (Extended mode) • 1 to 5V (Extended mode) The channel where the error has occurred fits in □.	• To perform disconnection detection using the input signal error detection function, set the input range of the corresponding channel to "4 to 20mA (Extended mode)" or "1 to 5V (Extended mode)". • Not to perform disconnection detection using the input signal error detection function, set Input signal error detection setting (Un\G27) of the corresponding channel to the value other than Disconnection detection (4).
90□[*1]	The values set in CH1 Scaling lower limit value (Un\G62) to CH4 Scaling upper limit value (Un\G69) are outside the range of -32000 to 32000. The channel where the error has occurred fits in □.	Set a value within the range of -32000 to 32000 in CH1 Scaling lower limit value (Un\G62) to CH4 Scaling upper limit value (Un\G69).
91□[*1]	The values set in CH1 Scaling lower limit value (Un\G62) to CH4 Scaling upper limit value (Un\G69) are as follows: Scaling upper limit value ≤ Scaling lower limit value. The channel where the error has occurred fits in □.	Set the values in CH1 Scaling lower limit value (Un\G62) to CH4 Scaling upper limit value (Un\G69) so that they meet the following condition: Scaling upper limit value > Scaling lower limit value
200□[*1]	CH□ Logging enable/disable setting (Un\G1000 to Un\G1003) is set to a value other than 0 and 1. The channel where the error has occurred fits in □.	Set Enable (0) or Disable (1) in CH□ Logging enable/disable setting (Un\G1000 to Un\G1003).
201□[*1]	A value outside the setting range is set in one or both of CH□ Logging cycle setting value (Un\G1032 to Un\G1035) or/and CH□ Logging cycle unit setting (Un\G1040 to Un\G1043). The channel where the error has occurred fits in □.	Set a value within the setting range in one or both of CH□ Logging cycle setting value (Un\G1032 to Un\G1035) or/and CH□ Logging cycle unit setting (Un\G1040 to Un\G1043). For the setting method of the logging cycle, refer to the following. • Logging Function (☞ Page 130, Section 8.13)
202□[*1]	The set logging cycle is shorter than the update cycle of the logged value (digital output value or digital operation value). The channel where the error has occurred fits in □.	Set CH□ Logging cycle setting value (Un\G1032 to Un\G1035) and CH□ Logging cycle unit setting (Un\G1040 to Un\G1043) so that the logging cycle is equal to or longer than the update cycle of the logged value. For the setting method of the logging cycle, refer to the following. • Logging Function (☞ Page 130, Section 8.13)
203□[*1]	CH□ Logging data setting (Un\G1024 to Un\G1027) is set to a value other than 0 and 1. The channel where the error has occurred fits in □.	Set Digital output value (0) or Digital operation value (1) in CH□ Logging data setting (Un\G1024 to Un\G1027).
204□[*1]	CH□ Logging points after trigger (Un\G1048 to Un\G1051) is set to a value outside the range of 1 to 10000. The channel where the error has occurred fits in □.	Set a value within the range of 1 to 10000 in CH□ Logging points after trigger (Un\G1048 to Un\G1051).
205□[*1]	CH□ Hold trigger condition setting (Un\G1056 to Un\G1059) is set to a value outside the range of 0 to 4. The channel where the error has occurred fits in □.	Set one of the following values in CH□ Hold trigger condition setting (Un\G1056 to Un\G1059). • Logging hold request (0) • Level trigger (Above) (1) • Level trigger (Below) (2) • Level trigger (Pass through) (3) • Outside trigger (4)
206□[*1]	CH□ Trigger data (Un\G1064 to Un\G1067) is set to a value outside the range of 0 to 4999. The channel where the error has occurred fits in □.	Set a value within the range of 0 to 4999 in CH□ Trigger data (Un\G1064 to Un\G1067).
207□[*1]	CH□ Logging hold request (Un\G1008 to Un\G1011) is set to a value other than 0 and 1. The channel where the error has occurred fits in □.	Set OFF (0) or ON (1) in CH□ Logging hold request (Un\G1008 to Un\G1011).

Error code (decimal)	Description and cause of error	Action
2200[*1]	When Outside trigger conversion request or Inside trigger conversion request (Buffer memory) is set to Conversion timing on Switch 4 on the intelligent function module switch setting, the following invalid functions are set to valid. • Rate alarm function • Logging function	When Outside trigger conversion request or Inside trigger conversion request (Buffer memory) is set to Conversion timing on Switch 4 on the intelligent function module switch setting, set the setting as follows: • Set b8 to b11 in Warning output setting (Un\G48) to Disable (1). • Set all CH☐ Logging enable/disable setting (Un\G1000 to Un\G1003) to Disable (1).
2201[*1]	Inside trigger conversion request (Un\G161) is set to a value other than No request (0) and Conversion request (1).	Set No request (0) or Conversion request (1) in Inside trigger conversion request (Un\G161).
2202[*1]	Trigger conversion completed clear request (Un\G163) is set to a value other than No request (0) and Clear request (1).	Set No request (0) or Clear request (1) in Trigger conversion completed clear request (Un\G163).
230☐[*1]	The values of CH☐ LPF Pass band edge frequency (Un\G300 to Un\G303) and CH☐ Attenuation band width (Un\G332 to Un\G335) are set beyond the setting range. The channel where the error has occurred fits in ☐.	Set the values of CH☐ LPF Pass band edge frequency (Un\G300 to Un\G303) and CH☐ Attenuation band width (Un\G332 to Un\G335) within the following setting range. [When the sampling cycle is 40(μs)] • Pass band edge frequency + Attenuation band width ≤ 12000 • 330 ≤ Attenuation band width • 0 ≤ Pass band edge frequency [When the sampling cycle is 80(μs)] • Pass band edge frequency + Attenuation band width ≤ 6000 • 170 ≤ Attenuation band width • 0 ≤ Pass band edge frequency
231☐[*1]	The values of CH☐ HPF Pass band edge frequency (Un\G308 to Un\G311) and CH☐ Attenuation band width (Un\G332 to Un\G335) are set beyond the setting range. The channel where the error has occurred fits in ☐.	Set the values of CH☐ HPF Pass band edge frequency (Un\G308 to Un\G311) and CH☐ Attenuation band width (Un\G332 to Un\G335) within the following setting range. [When the sampling cycle is 40(μs)] • 0 < Pass band edge frequency - Attenuation band width • 330 ≤ Attenuation band width • Pass band edge frequency ≤ 12000 [When the sampling cycle is 80(μs)] • 0 < Pass band edge frequency - Attenuation band width • 170 ≤ Attenuation band width • Pass band edge frequency ≤ 6000

Error code (decimal)	Description and cause of error	Action
232□*1	The values of CH1 BPF Pass band edge frequency (Low) (Un\G316) to CH4 BPF Pass band edge frequency (High) (Un\G323) and CH□ Attenuation band width (Un\G332 to Un\G335) are set beyond the setting range. The channel where the error has occurred fits in □.	Set the values of CH1 BPF Pass band edge frequency (Low) (Un\G316) to CH4 BPF Pass band edge frequency (High) (Un\G323) and CH□ Attenuation band width (Un\G332 to Un\G335) within the following setting range. [When the sampling cycle is 40(μs)] • Pass band edge frequency (High) + Attenuation band width ≤ 12000 • 0 < Pass band edge frequency (Low) - Attenuation band width • 330 ≤ Attenuation band width • Pass band edge frequency (Low) < Pass band edge frequency (High) [When the sampling cycle is 80(μs)] • Pass band edge frequency (High) + Attenuation band width ≤ 6000 • 0 < Pass band edge frequency (Low) - Attenuation band width • 170 ≤ Attenuation band width • Pass band edge frequency (Low) < Pass band edge frequency (High)
250□*1	CH□ Loading interrupt enable/disable setting (Un\G1200 to Un\G1203) is set to a value other than 0 and 1. The channel where the error has occurred fits in □.	Set Enable (0) or Disable (1) in CH□ Loading interrupt enable/disable setting (Un\G1200 to Un\G1203).
251□*1	The value set in CH□ Logging load points setting value (Un\G1208 to Un\G1211) is outside the range of 10 to 10000. The channel where the error has occurred fits in □.	Set a value within the range of 10 to 10000 in CH□ Logging load points setting value (Un\G1208 to Un\G1211).

*1 This error code can be cleared by turning on and then off Error clear request (YF).

*2 An error code is not stored in Latest error code (Un\G19) but in the completion status of the G(P).OGSTOR instruction (Ⓢ + 1).

11.5 Alarm Code List

The following shows an alarm code list.

Alarm code (decimal)	Description and cause of alarm	Action
10△□	A process alarm or a rate alarm is occurring. The channel where the process alarm or the rate alarm has occurred fits in □. A value fits in △ indicates that the alarm status is as follows: 0: Upper limit of a process alarm 1: Lower limit of a process alarm 2: Upper limit of a rate alarm 3: Lower limit of a rate alarm	The corresponding bit of Warning output flag (Process alarm) (Un\G50) and Warning output signal (X8) turn off automatically when the digital operation value returns to the value within the setting range at a process alarm. The corresponding bit of Warning output flag (Rate alarm) (Un\G51) and Warning output signal (X8) turn off automatically when the variation rate of the digital output value returns to the value within the setting range at a rate alarm. The alarm code can be cleared by turning on and off Error clear request (YF) after the digital output value returns to the value within the setting range.
11△□	An input signal error is occurring. The channel where the input signal error has occurred fits in □. A value fits in △ indicates that the detection status is as follows: 1: Upper limit detection 2: Lower limit detection 3: Disconnection detection This alarm code is stored when an input signal error is detected according to the setting of the input signal error detection function.	The corresponding bit of Input signal error detection flag (Un\G49) and Input signal error detection signal (XC) turn off by turning on and off Error clear request (YF) after the analog input value returns to the value within the setting range.

11.6 Troubleshooting

(1) When the RUN LED flashes or turns off

(a) When flashing

Check item	Action
Is the operation mode setting in the offset/gain setting mode?	Take either of the following actions: • switch the operation mode setting in the intelligent function module switch setting to the normal mode, or • correct Switch 4 in the intelligent function module switch setting to switch the operation mode setting to the normal mode.

(b) When turning off

Check item	Action
Is the power supplied?	Check that the supply voltage of the power supply module is within the rated range.
Is the capacity of the power supply module enough?	Calculate the current consumption of the connected modules such as the CPU module, I/O module, and intelligent function module, and check that the power supply capacity is sufficient.
Is there any watchdog timer error?	Reset the CPU module, and check that the RUN LED turns on. If the RUN LED remains off, the module may be failed. Please consult your local Mitsubishi representative.
Is the module connected properly?	Check the module connection.

(2) When the ERR. LED turns on or flashes

(a) When turning on

Check item	Action
Does any error occur?	Check the error code, and take the action described in the error code list. • Error Code List (☞ Page 221, Section 11.4)

(b) When flashing

Check item	Action
Is the value other than 0 set for Switch 5 in the intelligent function module switch setting?	With the parameter setting, set 0 for Switch 5 in the intelligent function module switch setting.

(3) When the ALM LED turns on or flashes

(a) When turning on

Check item	Action
Is there any warning output?	Check Warning output flag (Process alarm) (Un\G50) and Warning output flag (Rate alarm) (Un\G51).

(b) When flashing

Check item	Action
Is there any input signal error?	Check Input signal error detection flag (Un\G49).

(4) When a digital output value cannot be read

Check item	Action
Is there any problem with wiring, such as off or disconnection of analog signal lines?	Check the faulty area by checking signal line visually or conductively.
Is the CPU module in the STOP status?	Change the status of the CPU module to RUN.
Is the offset/gain setting correct?	Check that the offset/gain setting is correct. When the user range setting is selected, change the input range to the industrial shipment setting. Then check that the A/D conversion is executed. If the A/D conversion is properly executed, configure the offset/gain setting again.
Is the input range setting correct?	Check Setting range (Un\G20). When the input range setting is incorrect, configure the intelligent function module switch setting again.
Is A/D conversion enable/disable setting (Un\G0) set to be disabled for the channel to be used?	Check A/D conversion enable/disable setting (Un\G0). Then, enable A/D conversion with the program or the parameter of the intelligent function module.
Is Operating condition setting request (Y9) performed?	Check that the digital output value is stored in CH□ Digital output value (Un\G11 to Un\G14) after turning on then off Operating condition setting request (Y9). When the problem has been solved, check the program again.
Are the (V+) and (I+) terminals connected if the input source is current?	Always connect the (V+) and (I+) terminals for current input as shown in the external wiring example.
Are the setting values correct when the averaging processing is specified?	When selecting the time average processing, set the values that satisfy the following condition. • Setting value ≥ "4 (times) × sampling cycle" If the condition above is not satisfied, digital output values remain 0.

Point

If digital output values cannot be read even after the above actions are taken, the A/D converter module may be failed. Please consult your local Mitsubishi representative.

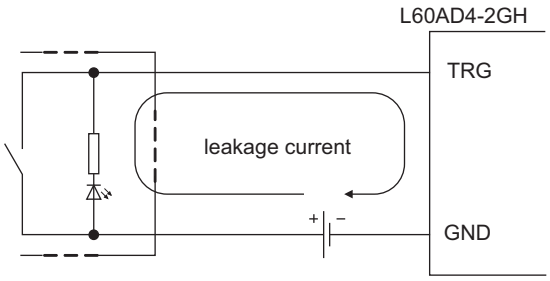
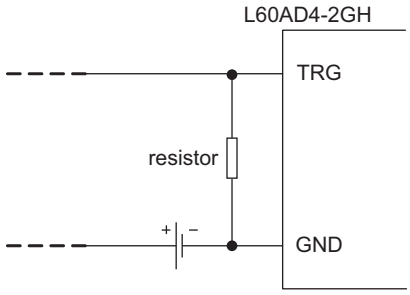
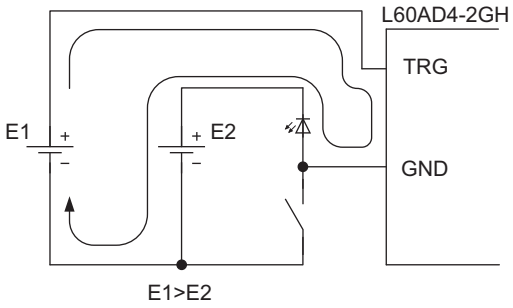
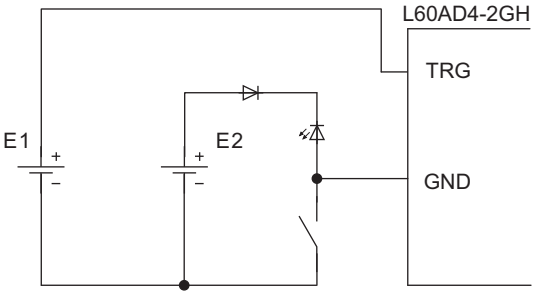
(5) When A/D conversion completed flag does not turn on in the normal mode

Check item	Action
Is there any input signal error?	Check Input signal error detection flag (Un\G49).

(6) When a digital output value does not fall within the range of accuracy

Check item	Action
Is any measure against noise taken?	Take measures against noise, such as using a shielded cable for connection.

(7) When the input signal of the external trigger terminal does not turn off

Check item	Action
Input by a switch with LED display 	Connect a proper resistor so that the current which flows in the A/D converter module is lower than the OFF current. 
Sneak current caused by two power supplies 	• Use one power supply only. • Connect a diode to prevent the sneak current. (Refer to the following figure.) 

(8) When an incorrect value is input from the external trigger terminal due to noise

Check item	Action
Noise may be taken as an input value.	Take the following measures. • Do not tie the power cables and I/O cables to prevent excessive noise. • Attach absorbers to the noise source such as relays or conductors used by the same power supply to suppress the noise.

11.7 Checking the Status of the A/D Converter Module by the System Monitor

To check the LED status or the setting status of the intelligent function module switch setting, select the H/W information of the A/D converter module on the system monitor of GX Works2.

(1) Hardware LED information

The LED status is displayed.

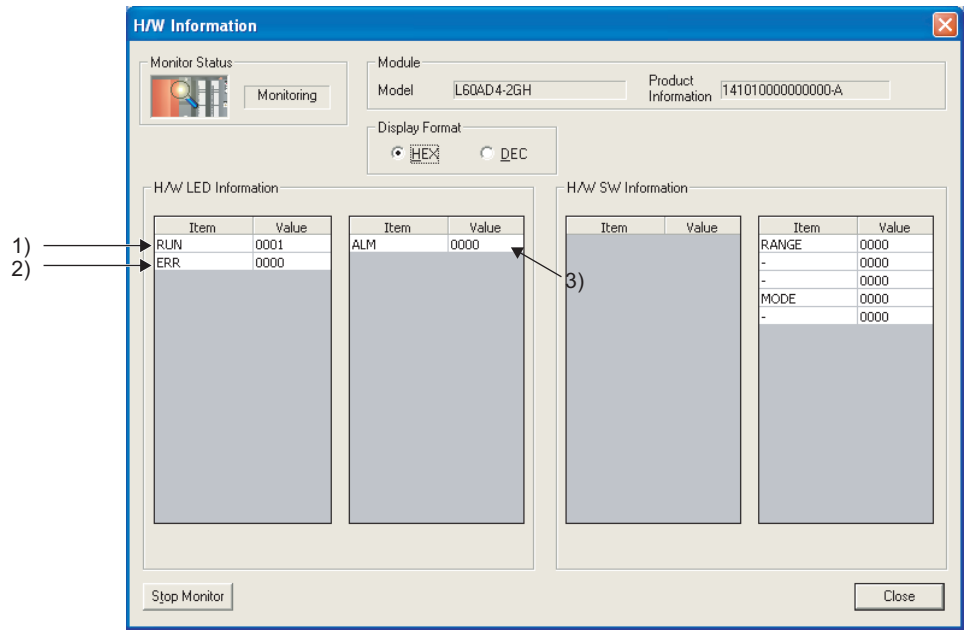
No.	LED name	Status
1)	RUN LED	0000_H: Indicates the LED off. 0001_H: Indicates the LED on. Alternating indication between 0000_H and 0001_H: Indicates the LED flashing. (Because the communication status of the A/D converter module is displayed on GX Works2, the values 0000_H and 0001_H are not always displayed evenly.)
2)	ERR. LED	
3)	ALM LED	

(2) Hardware switch information

The setting status of the intelligent function module switch setting is displayed.
For details on the setting status, refer to the following.

- Intelligent function module switch setting (☞ Page 297, Appendix 7.1)

Item	Intelligent function module switch
RANGE	Switch 1
–	Switch 2
–	Switch 3
MODE	Switch 4
–	Switch 5



APPENDICES

Appendix 1 Details of I/O Signals

The following describes the details of the I/O signals for the A/D converter module which are assigned to the CPU module.
The I/O numbers (X/Y) described in Appendix 1 are for the case when the start I/O number of the A/D converter module is set to 0.

Appendix 1.1 Input signal

(1) Module READY (X0)

Module READY (X0) turns on to indicate the preparation for the A/D conversion is completed after the power-on or after the reset operation of the CPU module, and the A/D conversion is performed.
In the following cases, Module READY (X0) turns off.

- In the offset/gain setting mode (In this case, the A/D conversion is performed.)
- When a watchdog timer error occurs in the A/D converter module (In this case, the A/D conversion is not performed.)

(2) Warning output signal (X8)

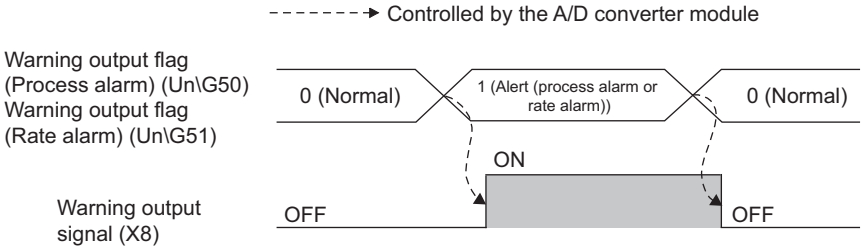
Warning output signal (X8) turns on when the process alarm or rate alarm has been detected.

(a) Process alarm

- Warning output signal (X8) turns on when digital operation values of the A/D conversion enabled channels exceed the ranges set for CH1 Process alarm lower lower limit value (Un\G86) to CH4 Process alarm upper upper limit value (Un\G101) after the process alarm is validated.
  The ALM LED also turns on along with the on of the signal.
- Warning output signal (X8) turns off when the digital operation values fall within the setting range for all the A/D conversion enabled channels.
  The ALM LED also turns off along with the off of the signal.

(b) Rate alarm

- Warning output signal (X8) turns on when the change rate of digital output values of the A/D conversion enabled channels at every rate alarm warning detection period exceed the ranges set for CH1 Rate alarm upper limit value (Un\G126) to CH4 Rate alarm lower limit value (Un\G133) after the rate alarm is validated.
  The ALM LED also turns on along with the on of the signal.
- Warning output signal (X8) turns off when the change rate of the digital output values fall within the setting range for all the A/D conversion enabled channels.
  The ALM LED also turns off along with the off of the signal.



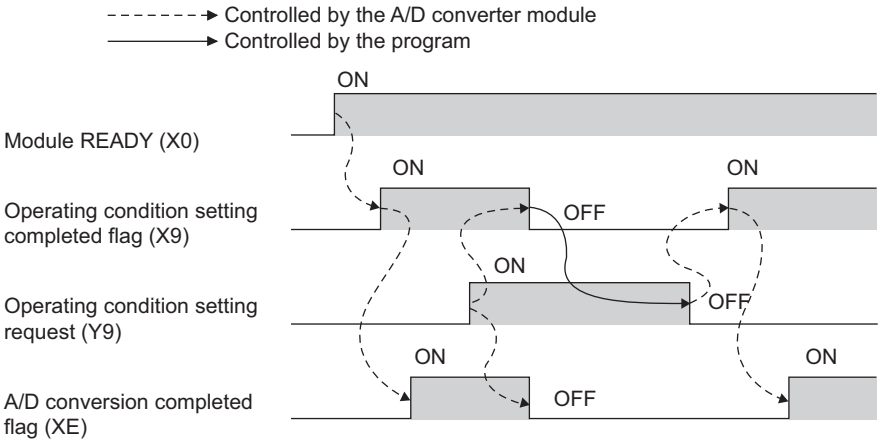
(3) Operating condition setting completed flag (X9)

When changing the following settings, use Operating condition setting completed flag (X9) as an interlock condition to turn on then off Operating condition setting request (Y9).

- A/D conversion enable/disable setting (Un\G0)
- CH☐ Time Average/Count Average/Moving Average/Time lag filter constant (Un\G1 to Un\G4)
- Averaging process setting (for the Q64AD) (Un\G9)
- Averaging process setting (Un\G24)
- Input signal error detection setting (Un\G27)
- Digital clipping enable/disable setting (Un\G29)
- Warning output setting (Un\G48)
- Scaling enable/disable setting (Un\G53)
- CH☐ Scaling lower limit value (Un\G62, Un\G64, Un\G66, Un\G68)
- CH☐ Scaling upper limit value (Un\G63, Un\G65, Un\G67, Un\G69)
- CH☐ Process alarm lower lower limit value (Un\G86, Un\G90, Un\G94, Un\G98)
- CH☐ Process alarm lower upper limit value (Un\G87, Un\G91, Un\G95, Un\G99)
- CH☐ Process alarm upper lower limit value (Un\G88, Un\G92, Un\G96, Un\G100)
- CH☐ Process alarm upper upper limit value (Un\G89, Un\G93, Un\G97, Un\G101)
- CH☐ Rate alarm detection cycle setting value (Un\G118 to Un\G121)
- CH☐ Rate alarm upper limit value (Un\G126, Un\G128, Un\G130, Un\G132)
- CH☐ Rate alarm lower limit value (Un\G127, Un\G129, Un\G131, Un\G133)
- CH☐ Input signal error detection setting value (Un\G142 to Un\G145)
- CH☐ LPF Pass band edge frequency (Un\G300 to Un\G303)
- CH☐ HPF Pass band edge frequency (Un\G308 to Un\G311)
- CH☐ BPF Pass band edge frequency (Low) (Un\G316, Un\G318, Un\G320, Un\G322)
- CH☐ BPF Pass band edge frequency (High) (Un\G317, Un\G319, Un\G321, Un\G323)
- CH☐ Attenuation band width (Un\G332 to Un\G335)
- CH☐ Logging enable/disable setting (Un\G1000 to Un\G1003)
- CH☐ Logging data setting (Un\G1024 to Un\G1027)
- CH☐ Logging cycle setting value (Un\G1032 to Un\G1035)
- CH☐ Logging cycle unit setting (Un\G1040 to Un\G1043)
- CH☐ Logging points after trigger (Un\G1048 to Un\G1051)
- CH☐ Hold trigger condition setting (Un\G1056 to Un\G1059)
- CH☐ Trigger data (Un\G1064 to Un\G1067)
- CH☐ Trigger setting value (Un\G1082 to Un\G1085)
- CH☐ Loading interrupt enable/disable setting (Un\G1200 to Un\G1203)
- CH☐ Logging load points setting value (Un\G1208 to Un\G1211)

When Operating condition setting completed flag (X9) is off, the A/D conversion is not performed.
In the case of the following status, Operating condition setting completed flag (X9) turns off.

- When Operating condition setting request (Y9) is on

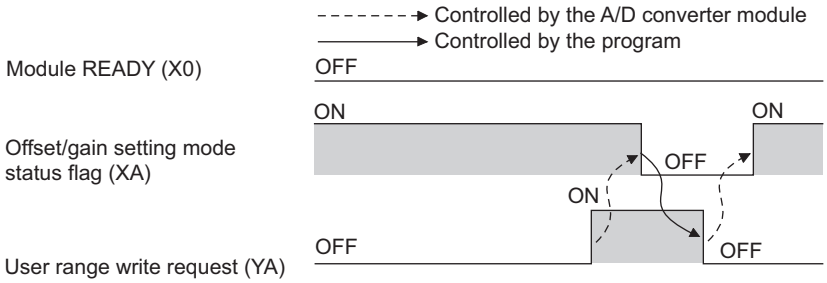


(4) Offset/gain setting mode flag (XA)

(a) Offset/gain setting mode

When registering the value, which has been adjusted with the offset/gain setting, to the module, use Offset/gain setting mode flag (XA) as an interlock condition to turn on then off User range write request (YA).
For the offset/gain setting, refer to the following.

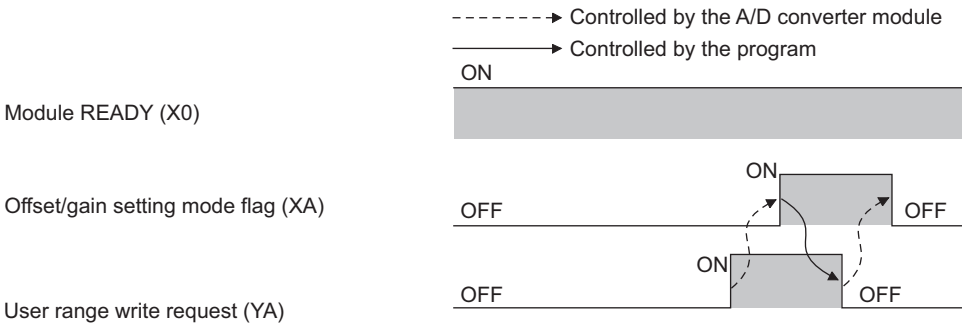
- Offset/gain Setting (☞Page 62, Section 7.5)



(b) Normal mode

In the user range restoration, use Offset/gain setting mode flag (XA) as an interlock condition to turn on then off User range write request (YA).
For user range restoration, refer to the following.

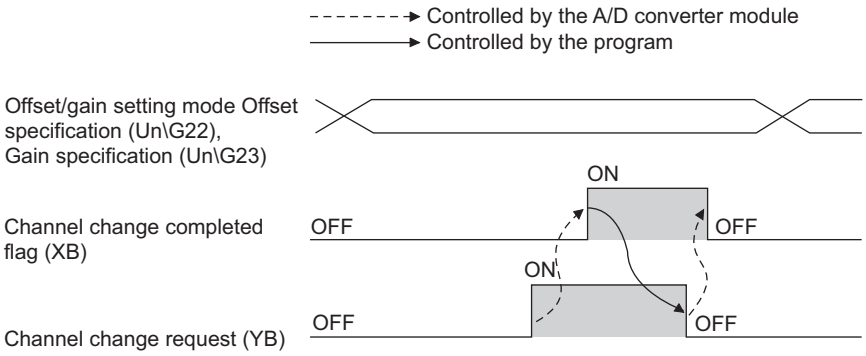
- Saving/restoring offset/gain values (☞Page 62, Section 7.5)



(5) Channel change completed flag (XB)

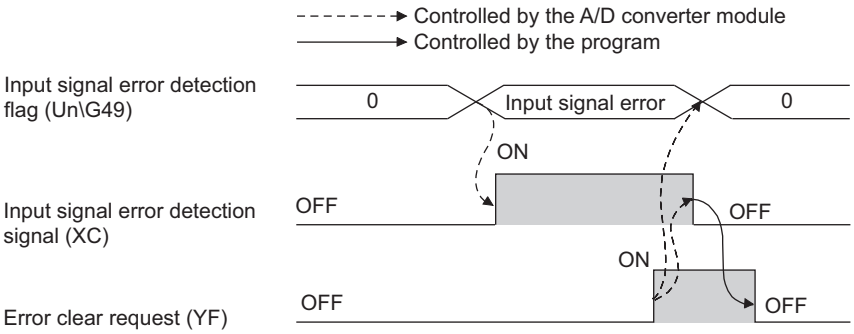
When changing a channel to perform the offset/gain setting, use Channel change completed flag (XB) as an interlock condition to turn on then off Channel change request (YB).
For the offset/gain setting, refer to the following.

- Offset/gain Setting (☞Page 62, Section 7.5)



(6) Input signal error detection signal (XC)

Input signal error detection signal (XC) turns on when an analog input value exceeds the range set with CH☐ Input signal error detection setting value (Un\G142 to Un\G145) in any channel which has been A/D conversion-enabled, after the detection condition is set in Input signal error detection setting (Un\G27). When a disconnection is detected, the signal ignores the setting for CH☐ Input signal error detection setting value (Un\G142 to Un\G145), and turns on at the disconnection detection.



(a) When Input signal error detection signal (XC) turns on

- During conversion or unused (0) is stored in A/D conversion completed flag (Un\G10) for the corresponding channels.
- The channel where the error was detected holds the preceding digital output value just before the error detection in the buffer memory.
- The ALM LED flashes.

(b) When Input signal error detection signal (XC) turns off

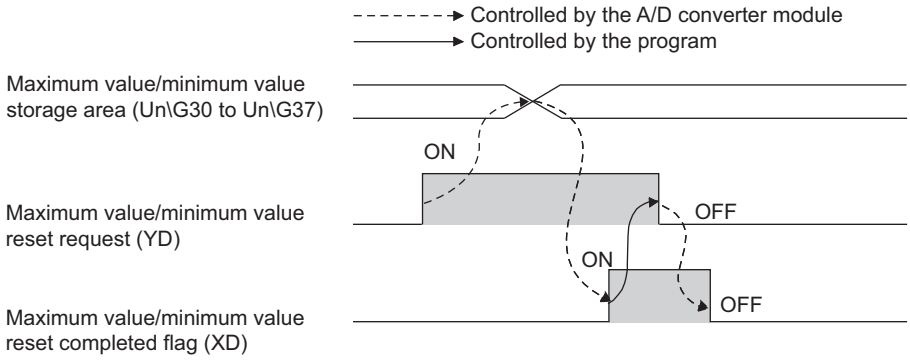
- The ALM LED turns off.
- Latest error code (Un\G19) is cleared.

Point

When the analog input value falls within the range set, A/D conversion resumes even though Input signal error detection signal (XC) is reset. When the first A/D conversion after the resumption is completed, A/D conversion completed flag (Un\G10) turns to Conversion completed (1). (The ALM LED remains flashing.)
Averaging processing starts over after the A/D conversion resumes.

(7) Maximum value/minimum value reset completed flag (XD)

Maximum value/minimum value reset completed flag (XD) turns on after the maximum and minimum values stored in CH□ Maximum value (Un\G30, Un\G32, Un\G34, Un\G36) and CH□ Minimum value (Un\G31, Un\G33, Un\G35, Un\G37) are reset by turning on then off Maximum value/minimum value reset request (YD).

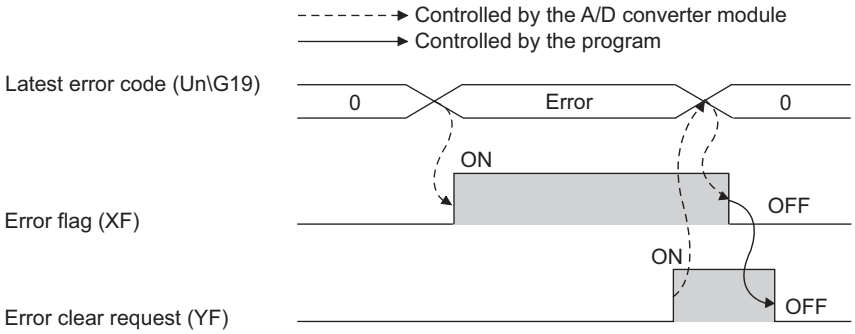


(8) A/D conversion completed flag (XE)

A/D conversion completed flag (XE) turns on when all A/D conversion-enabled channels are converted.

(9) Error flag (XF)

Error flag (XF) turns on when an error occurs.



(a) Clearing the latest error code and Error flag (XF)

Turn on then off Error clear request (YF).

Appendix 1.2 Output signal

(1) Operating condition setting request (Y9)

To validate the following settings, turn on then off Operating condition setting request (Y9).

- A/D conversion enable/disable setting (Un\G0)
- CH☐ Time Average/Count Average/Moving Average/Time lag filter constant (Un\G1 to Un\G4)
- Averaging process setting (for the Q64AD) (Un\G9)
- Averaging process setting (Un\G24)
- Input signal error detection setting (Un\G27)
- Digital clipping enable/disable setting (Un\G29)
- Warning output setting (Un\G48)
- Scaling enable/disable setting (Un\G53)
- CH☐ Scaling lower limit value (Un\G62, Un\G64, Un\G66, Un\G68)
- CH☐ Scaling upper limit value (Un\G63, Un\G65, Un\G67, Un\G69)
- CH☐ Process alarm lower lower limit value (Un\G86, Un\G90, Un\G94, Un\G98)
- CH☐ Process alarm lower upper limit value (Un\G87, Un\G91, Un\G95, Un\G99)
- CH☐ Process alarm upper lower limit value (Un\G88, Un\G92, Un\G96, Un\G100)
- CH☐ Process alarm upper upper limit value (Un\G89, Un\G93, Un\G97, Un\G101)
- CH☐ Rate alarm detection cycle setting value (Un\G118 to Un\G121)
- CH☐ Rate alarm upper limit value (Un\G126, Un\G128, Un\G130, Un\G132)
- CH☐ Rate alarm lower limit value (Un\G127, Un\G129, Un\G131, Un\G133)
- CH☐ Input signal error detection setting value (Un\G142 to Un\G145)
- CH☐ LPF Pass band edge frequency (Un\G300 to Un\G303)
- CH☐ HPF Pass band edge frequency (Un\G308 to Un\G311)
- CH☐ BPF Pass band edge frequency (Low) (Un\G316, Un\G318, Un\G320, Un\G322)
- CH☐ BPF Pass band edge frequency (High) (Un\G317, Un\G319, Un\G321, Un\G323)
- CH☐ Attenuation band width (Un\G332 to Un\G335)
- CH☐ Logging enable/disable setting (Un\G1000 to Un\G1003)
- CH☐ Logging data setting (Un\G1024 to Un\G1027)
- CH☐ Logging cycle setting value (Un\G1032 to Un\G1035)
- CH☐ Logging cycle unit setting (Un\G1040 to Un\G1043)
- CH☐ Logging points after trigger (Un\G1048 to Un\G1051)
- CH☐ Hold trigger condition setting (Un\G1056 to Un\G1059)
- CH☐ Trigger data (Un\G1064 to Un\G1067)
- CH☐ Trigger setting value (Un\G1082 to Un\G1085)
- CH☐ Loading interrupt enable/disable setting (Un\G1200 to Un\G1203)
- CH☐ Logging load points setting value (Un\G1208 to Un\G1211)

For the timing of turning the signal on then off, refer to the following.

- Operating condition setting completed flag (X9) (☞Page 234, Appendix 1.1 (3))

(2) User range write request (YA)

(a) Offset/gain setting mode

Turn on then off User range write request (YA) to register values adjusted with the offset/gain setting in the A/D converter module.

The data is written to the flash memory when this signal is turned off then on.

For the timing of turning the signal on then off, refer to the following.

- Offset/gain setting mode flag (XA) (☞Page 235, Appendix 1.1 (4))

(b) Normal mode

Turn on then off User range write request (YA) to restore the user range.

For the timing of turning the signal on then off, refer to the following.

- Offset/gain setting mode flag (XA) (☞Page 235, Appendix 1.1 (4))

(3) Channel change request (YB)

Turn on then off Channel change request (YB) to change a channel to perform the offset/gain setting.

For the timing of turning the signal on then off, refer to the following.

- Channel change completed flag (XB) (☞Page 236, Appendix 1.1 (5))

(4) Maximum value/minimum value reset request (YD)

Turn on then off Maximum value/minimum value reset request (YD) to clear the maximum and minimum values stored in CH□ Maximum value (Un\G30, Un\G32, Un\G34, Un\G36) and CH□ Minimum value (Un\G31, Un\G33, Un\G35, Un\G37).

For the timing of turning the signal on then off, refer to the following.

- Maximum value/minimum value reset completed flag (XD) (☞Page 237, Appendix 1.1 (7))

(5) Error clear request (YF)

To clear Error flag (XF), Input signal error detection signal (XC), and Latest error code (Un\G19), turn on then off Error clear request (YF).

For the timing of turning the signal on then off, refer to the following.

- Input signal error detection signal (XC) (☞Page 236, Appendix 1.1 (6))
- Error flag (XF) (☞Page 237, Appendix 1.1 (9))

Appendix 2 Details of Buffer Memory Addresses

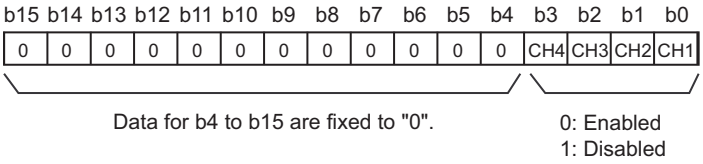
The following describes the details of buffer memory addresses of the A/D converter module.

(1) A/D conversion enable/disable setting (Un\G0)

Set whether the A/D conversion is enabled or disabled for each channel.

For details on the A/D conversion enable/disable function, refer to the following.

• A/D Conversion Enable/disable Function (☞Page 73, Section 8.3)


b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0
0 0 0 0 0 0 0 0 0 0 0 0 CH4 CH3 CH2 CH1
Data for b4 to b15 are fixed to "0".
0: Enabled
1: Disabled

(a) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(b) Default value

The default value is Enabled (0). (All channels)

(2) CH☐ Time Average/Count Average/Moving Average/Time lag filter constant (Un\G1 to Un\G4)

Configure the time, count, moving average, and time lag filter constant for each channel to which the averaging processing is specified.

The following table lists the setting range.

Processing method	Setting value
Time average	2 to 5000 (ms)
Count average	4 to 65000 (times)
Moving average	2 to 1000 (times)
Time lag filter	1 to 500 (Times)

(a) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(b) Default value

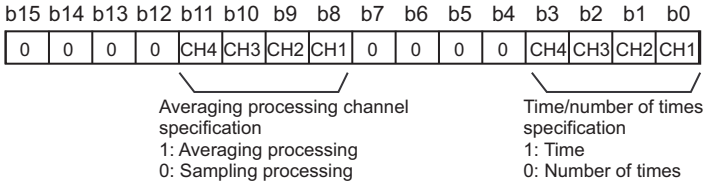
The default value is 0. (All channels)

Point

- A channel where a value out of the above setting range is set brings about an error. The error code (30☐, 31☐, or 32☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on. The A/D conversion is performed with the setting before the error.
- Set the time lag filter constant for Time lag filter. The value of the time constant (unit: ms) is the product of the time lag filter constant and the sampling cycle. When a value out of the range is set, an error occurs. The error code (32☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on. The A/D conversion is performed with the setting before the error.
- The default value is 0. Change the value according to the processing method.
- When the sampling processing is set to the channel to which the setting value has been set, the setting value is ignored.

(3) Averaging process setting (for the Q64AD) (Un\G9)

Write the setting of averaging processing for each channel when using a program for initial setting of the Q64AD.


b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0
0 0 0 0 CH4 CH3 CH2 CH1 0 0 0 0 CH4 CH3 CH2 CH1
Averaging processing channel specification
1: Averaging processing
0: Sampling processing
Time/number of times specification
1: Time
0: Number of times

(a) Enabling the setting

To enable the setting, turn on then off Operating condition setting request (Y9) after setting Averaging process setting (Un\G24) to Sampling processing (0).

Point

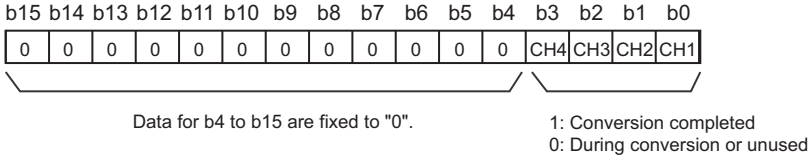
- When selecting the moving average, write 0 to Averaging process setting (for the Q64AD) (Un\G9), and write the moving average setting to Averaging process setting (Un\G24).
- In an operation with the A/D conversion timing set to External Trigger Convert Request (External Input Terminal) or Internal Trigger Conversion Request (Buffer Memory), the setting value is ignored and Sampling processing (0) is set.

(b) Default value

The default value is Sampling processing (0). (All channels)

(4) A/D conversion completed flag (Un\G10)

A/D conversion status can be checked with this flag.


b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0
0 0 0 0 0 0 0 0 0 0 0 0 CH4 CH3 CH2 CH1
Data for b4 to b15 are fixed to "0".
1: Conversion completed
0: During conversion or unused

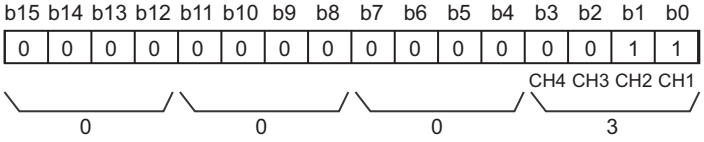
(a) A/D conversion completion

When the first A/D conversion is completed in the channel where the A/D conversion is enabled, the flag turns to Conversion completed (1).

A/D conversion completed flag (XE) turns on when the conversion of all the channels where the A/D conversion is enabled are completed.

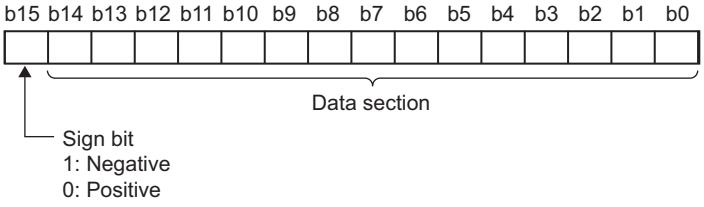
Turning on then off Operating condition setting request (Y9) turns the flag to 0 (default value), and the flag turns to Conversion completed (1) when the first A/D conversion is completed.

Ex. When Enabled is set to CH1 and CH2, and all the A/D conversions in CH1 and CH2 are completed, 0003_H (3) is stored in A/D conversion completed flag (Un\G10) as shown below.



(5) CH□ Digital output value (Un\G11 to Un\G14)

The A/D-converted digital output value is stored in 16-bit signed binary.



(a) Updating cycle

For the conversion cycle, refer to the following.

- Conversion cycle (☞Page 75, Section 8.4 (1) (c))

(6) Latest error code (Un\G19)

The latest error code or alarm code detected in the A/D converter module is stored.

For details on error codes and alarm codes, refer to the following.

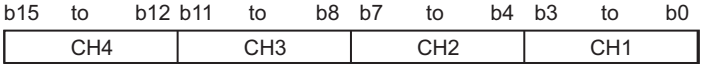
- Error Code List (☞Page 221, Section 11.4)
- Alarm Code List (☞Page 226, Section 11.5)

(a) Clearing an error

Turn on then off Error clear request (YF).

(7) Setting range (Un\G20)

The range which was set as the input range can be checked.



Input range	Setting value
4 to 20mA	0_H
0 to 20mA	1_H
1 to 5V	2_H
0 to 5V	3_H
-10 to 10V	4_H
0 to 10V	5_H
4 to 20mA (Extended mode)	A_H
1 to 5V (Extended mode)	B_H
User range setting (uni-polar: current)	E_H
User range setting (bi-polar: voltage)	F_H

Point

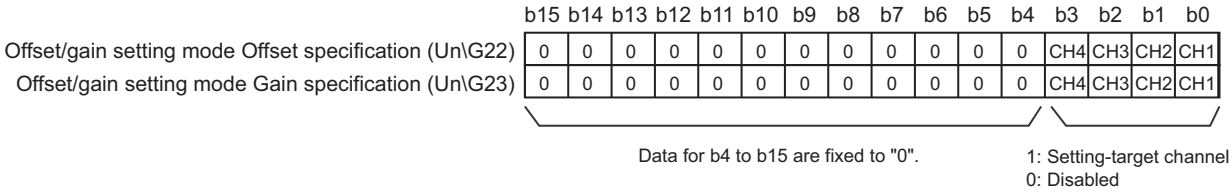
- Input range cannot be changed in Setting range (Un\G20).
  For changing the setting, refer to the following.
  - Switch Setting (Page 57, Section 7.2)
- $FFFF_H$ is set in the offset/gain setting mode.

(8) Offset/gain setting mode Offset specification (Un\G22), Offset/gain setting mode Gain specification (Un\G23)

Specify the channel to perform the offset/gain setting adjustment.

Offset/gain setting mode Offset specification (Un\G22): channel to adjust the offset

Offset/gain setting mode Gain specification (Un\G23): channel to adjust the gain


b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0
Offset/gain setting mode Offset specification (Un\G22)
Offset/gain setting mode Gain specification (Un\G23)
0 0 0 0 0 0 0 0 0 0 0 0 CH4 CH3 CH2 CH1
0 0 0 0 0 0 0 0 0 0 0 0 CH4 CH3 CH2 CH1
Data for b4 to b15 are fixed to "0".
1: Setting-target channel
0: Disabled

(a) Default value

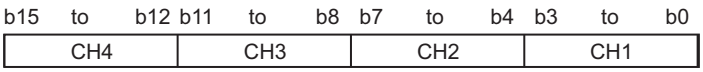
The default value is 0000_H.

Point

- The settings for multiple channels can be configured at the same time. However, set either of Offset/gain setting mode Offset specification (Un\G22) or Offset/gain setting mode Gain specification (Un\G23) to Disabled (0).
  When the settings for both of them are configured at the same time, an error occurs. The error code (500) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on.
- For details on the offset/gain setting, refer to the following.
  - Offset/gain Setting (☞ Page 62, Section 7.5)

(9) Averaging process setting (Un\G24)

Configure the setting when selecting sampling or averaging processing for each channel.
Averaging processing includes time average, count average, moving average, time lag filter, low pass filter, high pass filter, and band pass filter.



Processing method	Setting value
Sampling processing	0_H
Time average	1_H
Count average	2_H
Moving average	3_H
Time lag filter	4_H
Low pass filter	5_H
High pass filter	6_H
Band pass filter	7_H

(a) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(b) Default value

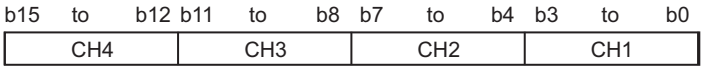
The default value is Sampling processing (0). (All channels)

Point

- When using Averaging process setting (for the Q64AD) (Un\G9), the value set in Averaging process setting (Un\G24) is ignored. (The operation is performed according to Averaging process setting (for the Q64AD) (Un\G9).
- In an operation with the A/D conversion timing set to External Trigger Convert Request (External Input Terminal) or Internal Trigger Conversion Request (Buffer Memory), the setting value is ignored and Sampling processing (0) is set.
- A channel where a value out of the above setting range is written operates with the sampling processing.

(10)Input signal error detection setting (Un\G27)

Set the detection method of input signal errors for each channel.



Detection method	Setting value
Disable	0_H
Upper and Lower Detection	1_H
Lower Detection	2_H
Upper Detection	3_H
Disconnection Detection	4_H

(a) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(b) Default value

The default value is Disable (0). (All channels)

Point

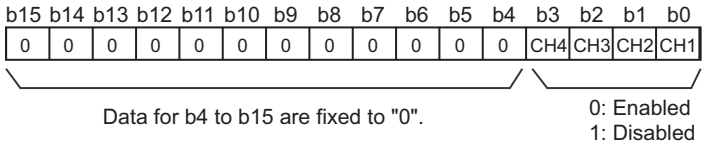
- A channel where a value out of the above setting range is set brings about an error.
  Error code (81☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on. The operation is performed with the setting before the error.
- Disconnection Detection (4) is valid only when the input range is set as 4 to 20mA (extended mode) or 1 to 5V (extended mode). When the channel with the other range is set to Disconnection Detection (4), an error occurs. Error code (82☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on.

(11)Digital clipping enable/disable setting (Un\G29)

Set whether the digital clipping function is enabled or disabled for each channel.

For details on the digital clipping function, refer to the following.

- Digital Clipping Function (☞Page 122, Section 8.11)


b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0
0 0 0 0 0 0 0 0 0 0 0 0 CH4 CH3 CH2 CH1
Data for b4 to b15 are fixed to "0".
0: Enabled
1: Disabled

(a) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(b) Default value

The default value is Disabled (1). (All channels)

(12)CH□ Maximum value (Un\G30, Un\G32, Un\G34, Un\G36), CH□ Minimum value (Un\G31, Un\G33, Un\G35, Un\G37)

The maximum and minimum values of a digital operation value converted for each channel are stored in 16-bit signed binary.

In the following cases, CH□ Maximum value (Un\G30, Un\G32, Un\G34, Un\G36) and CH□ Minimum value (Un\G31, Un\G33, Un\G35, Un\G37) are updated with the current value.

- When turning on then off Operating condition setting request (Y9) changes the setting
- When Maximum value/minimum value reset request (YD) is turned on then off

Point

- For the channel to which the averaging processing is specified, the maximum and minimum values are stored at averaging processing time intervals.
- When the following functions are used, the values calculated by each function are stored in CH□ Maximum value (Un\G30, Un\G32, Un\G34, Un\G36) and CH□ Minimum value (Un\G31, Un\G33, Un\G35, Un\G37).
  - Digital clipping function
  - Scaling function
  - Shift function
  - Difference conversion function

(13)Offset/gain range specification (Un\G46)

The input range can be changed in the offset/gain setting.

Set uni-polar (current: $000E_H$) or bi-polar (voltage: $000F_H$) as the user range.

Input range	Setting value
Uni-polar (current)	$000E_H$
Bi-polar (voltage)	$000F_H$

(a) Enabling the setting

When Channel change request (YB) is turned on then off, the setting of the input range is enabled.

(b) Default value

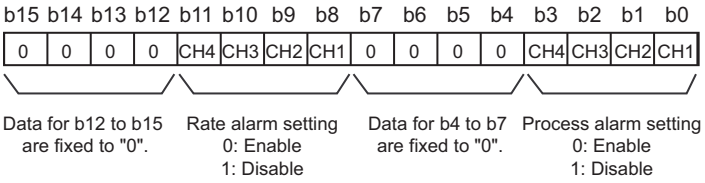
The default value is 0000_H.

Point

When a value out of the setting range above is set, an error occurs. The error code (171) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on.

(14)Warning output setting (Un\G48)

Set whether the warning output of process alarm and rate alarm is enabled or disabled for each channel.


b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0
0 0 0 0 CH4 CH3 CH2 CH1 0 0 0 0 CH4 CH3 CH2 CH1
Data for b12 to b15 are fixed to "0".
Rate alarm setting 0: Enable 1: Disable
Data for b4 to b7 are fixed to "0".
Process alarm setting 0: Enable 1: Disable

(a) Enabling the setting

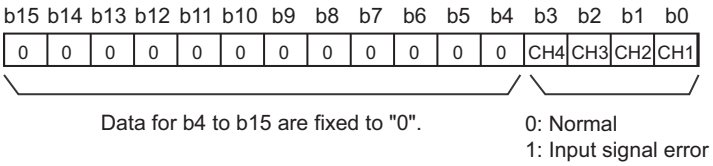
Turn on then off Operating condition setting request (Y9) to enable the setting.

(b) Default value

The default value is Disable (1). (All channels)

(15)Input signal error detection flag (Un\G49)

Input signal status can be checked with this flag for each channel.


b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0
0 0 0 0 0 0 0 0 0 0 0 0 CH4 CH3 CH2 CH1
Data for b4 to b15 are fixed to "0".
0: Normal 1: Input signal error

(a) Input signal error detection flag (Un\G49) status

- When an analog input value out of the setting range for CH□ Input signal error detection setting value (Un\G142 to Un\G145) is detected, Input signal error detection flag (Un\G49) corresponding to each channel is turned to Input signal error (1).
- Even an single error detected in any A/D conversion enable or input signal error detection enable channels cause Input signal error detection signal (XC) to turn on.

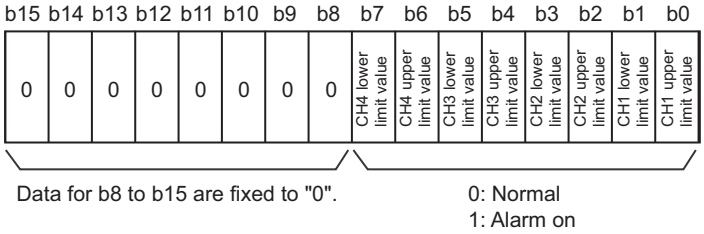
(b) Clearing Input signal error detection flag (Un\G49)

Input signal error detection flag (Un\G49) can be cleared in the following two procedures.

- Turn on then off Operating condition setting request (Y9)
- Turn on then off Error clear request (YF)

(16)Warning output flag (Process alarm) (Un\G50)

Whether the Process alarm is the upper limit warning or lower limit warning can be checked for each channel.


b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0
0 0 0 0 0 0 0 0
CH4 lower limit value
CH4 upper limit value
CH3 lower limit value
CH3 upper limit value
CH2 lower limit value
CH2 upper limit value
CH1 lower limit value
CH1 upper limit value
Data for b8 to b15 are fixed to "0".
0: Normal
1: Alarm on

(a) Warning output flag (Process alarm) (Un\G50) status

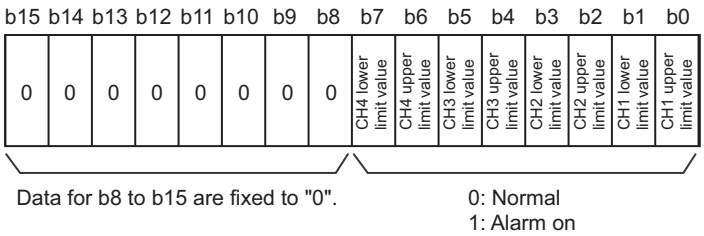
- When the value is out of the range specified in CH1 Process alarm lower lower limit value (Un\G86) to CH4 Process alarm upper upper limit value (Un\G101), Warning output flag (Process alarm) (Un\G50) corresponding to each channel is turned to Alarm ON (1).
- When a warning is detected in any A/D conversion enable or process alarm output enable channels, Warning output signal (X8) also turns on.

(b) Clearing Warning output flag (Process alarm) (Un\G50)

- When the digital operation value returns within the setting range, the flag is automatically cleared.
- When Operating condition setting request (Y9) is turned on then off, it is cleared.

(17)Warning output flag (Rate alarm) (Un\G51)

Whether the Rate alarm is the upper limit warning or lower limit warning is checked for each channel.


b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0
0 0 0 0 0 0 0 0
CH4 lower limit value
CH4 upper limit value
CH3 lower limit value
CH3 upper limit value
CH2 lower limit value
CH2 upper limit value
CH1 lower limit value
CH1 upper limit value
Data for b8 to b15 are fixed to "0".
0: Normal
1: Alarm on

(a) Warning output flag (Rate alarm) (Un\G51) status

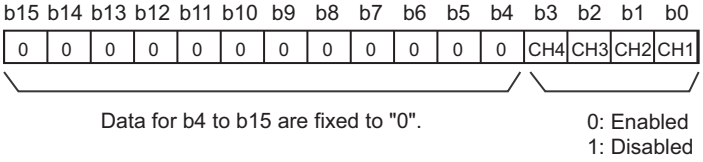
- When the value is out of the range of the set change rate specified in CH1 Rate alarm upper limit value (Un\G126) to CH4 Rate alarm lower limit value (Un\G133), Warning output flag (Rate alarm) (Un\G51) corresponding to each channel is turned to Alarm ON (1).
- When a warning is detected in any A/D conversion enable or rate alarm output enable channels, Warning output signal (X8) also turns on.

(b) Clearing Warning output flag (Rate alarm) (Un\G51)

- When the digital output value returns within the setting range, the flag is automatically cleared.
- When Operating condition setting request (Y9) is turned on then off, it is cleared.

(18)Scaling enable/disable setting (Un\G53)

Set whether the scaling is enabled or disabled for each channel.


b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0
0 0 0 0 0 0 0 0 0 0 0 0 CH4 CH3 CH2 CH1
Data for b4 to b15 are fixed to "0".
0: Enabled
1: Disabled

(a) Enabling the setting

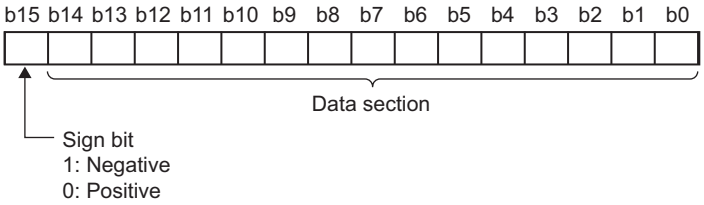
Turn on then off Operating condition setting request (Y9) to enable the setting.

(b) Default value

The default value is Disabled (1). (All channels)

(19)CH□ Digital operation value (Un\G54 to Un\G57)

A digital operation value obtained by the digital clipping function, scaling function, shift function, or difference conversion function is stored in 16-bit signed binary.



Point

When the digital clipping function, scaling function, shift function, or difference conversion function is not used, the same value as the one in CH□ Digital output value (Un\G11 to Un\G14) is stored.

(20)CH□ Scaling lower limit value (Un\G62, Un\G64, Un\G66, Un\G68), CH□ Scaling upper limit value (Un\G63, Un\G65, Un\G67, Un\G69)

Set the range of scale conversion for each channel.

For details on the scaling function, refer to the following.

- Scaling Function (☞Page 110, Section 8.9)

(a) Setting range

Setting range: -32000 to 32000 (scaling upper limit value > scaling lower limit value)

(b) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(c) Default value

The default value is 0. (All channels)

Point

- When a value set to a channel is out of the setting range above or a value not satisfying "scaling upper limit value > scaling lower limit value", an error occurs at the channel. Error code (90□ or 91□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on.
- Change the setting value since 0 is set as the default value.
- When Scaling enable/disable setting (Un\G53) is set to Disabled (1), the settings for CH□ Scaling lower limit value (Un\G62, Un\G64, Un\G66, Un\G68) and CH□ Scaling upper limit value (Un\G63, Un\G65, Un\G67, Un\G69) are ignored.

(21)CH□ Process alarm lower lower limit value (Un\G86, Un\G90, Un\G94, Un\G98), CH□ Process alarm lower upper limit value (Un\G87, Un\G91, Un\G95, Un\G99), CH□ Process alarm upper lower limit value (Un\G88, Un\G92, Un\G96, Un\G100), CH□ Process alarm upper upper limit value (Un\G89, Un\G93, Un\G97, Un\G101)

Set the range of the digital operation value for each channel.

For details on the process alarm, refer to the following.

- Process alarm (☞Page 102, Section 8.8.1)

(a) Setting range

- The setting range is between -32768 and 32767.
- Configure the four-step setting of process alarm upper upper limit value, process alarm upper lower limit value, process alarm lower upper limit value, and process alarm lower lower limit value.

(b) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(c) Default value

The default value is 0. (All channels)

Point

- When a value out of the setting range above or a value not satisfying the formula of process alarm upper upper limit value ≥ process alarm upper lower limit value ≥ process alarm lower upper limit value ≥ process alarm lower lower limit value is set to a channel, an error occurs in the channel. Error code (6△□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on. The operation is performed with the setting before the error.
- Change the setting value since 0 is set as the default value.
- When the following functions are used, warning targets are digital operation values that reflect the operations of each function. Set values considering operation results of each function.
  - Digital clipping function
  - Scaling function
  - Shift function
  - Difference conversion function

(22)CH□ Rate alarm detection cycle setting value (Un\G118 to Un\G121)

Set the cycle to check the change rate of digital output values for each channel.

The product of the setting value and the conversion cycle is the value for the cycle to detect the warning of a rate alarm.

(a) Setting range

The setting range is between 1 and 32000 (times).

(b) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(c) Default value

The default value is 1 (time). (All channels)

Point

A channel where a value out of the above setting range is set brings about an error.
Error code (71□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on.

(23)CH□ Rate alarm upper limit value (Un\G126, Un\G128, Un\G130, Un\G132), CH□ Rate alarm lower limit value (Un\G127, Un\G129, Un\G131, Un\G133)

Set the change rate range of the digital output value for each channel.

For details on the rate alarm, refer to the following.

- Rate alarm (☞Page 105, Section 8.8.2)

(a) Setting range

- The setting range is between -32768 and 32767 (-3276.8 to 3276.7%) (set in a unit of 0.1%).
- Configure the two-step setting of the rate alarm upper limit value and rate alarm lower limit value.

(b) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(c) Default value

The default value is 0. (All channels)

Point

- When a value out of the above setting range or a value not satisfying the formula of rate alarm lower limit value ≤ rate alarm upper limit value is set to a channel, an error occurs in the channel. Error code (70□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on. The operation is performed with the setting before the error.
- Change the setting value since 0 is set as the default value.

(24)CH□ Input signal error detection setting value (Un\G142 to Un\G145)

Set the setting value to detect an error for an input analog value for each channel.

For details on the input signal error detection function, refer to the following.

- Input Signal Error Detection Function (☞Page 96, Section 8.7)

(a) Setting procedure

- The setting range is between 0 and 250 (0 to 25.0%). Set it in a unit of 1 (0.1%).
- The input signal error detection upper and lower limit values are calculated as follows based on the input signal error detection setting value. The calculated input signal error detection upper and lower limit values vary depending on the input range used.

[Input signal error detection upper limit value]

$$\text{Gain value of each range} + \left(\text{Gain value of each range} - \text{Offset value of each range}\right) \times \frac{\text{Input signal error detection setting value}}{1000}$$

[Input signal error detection lower limit value]

$$\text{Lower limit value of each range} - \left(\text{Gain value of each range} - \text{Offset value of each range}\right) \times \frac{\text{Input signal error detection setting value}}{1000}$$

Ex. When the input signal error detection setting value is set to 100 (10%)

Range used: 4 to 20mA

The upper and lower limit values of input signal error detection are as follows:

$$\text{Input signal error detection upper limit value} = 20 + (20 - 4) \times \frac{100}{1000} = 21.6\text{mA}$$

$$\text{Input signal error detection lower limit value} = -4 - (20 - 4) \times \frac{100}{1000} = -2.4\text{mA}$$

- Conditions vary as follows depending on the setting in Input signal error detection setting (Un\G27).

Input signal error detection setting (Un\G27)	Detection condition
Upper and Lower Detection (1)	At the input signal error detection upper limit value or the input signal error detection lower limit value
Lower Detection (2)	At the input signal error detection lower limit value
Upper Detection (3)	At the input signal error detection upper limit value
Disconnection Detection (4)	• In 2mA or less, or 0.5V or less • The setting for CH□ Input signal error detection setting value (Un\G142 to Un\G145) is ignored. • Input range other than 4 to 20mA (extended mode) or 1 to 5V (extended mode) cannot be used.

(b) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(c) Default value

The default value is 5% (50). (All channels)

Point

A channel where a value out of the above setting range is set brings about an error.
Error code (80□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on. The operation is performed with the setting before the error.

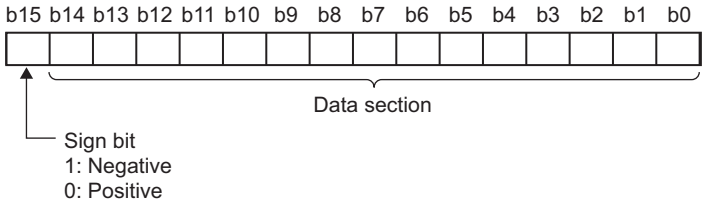
(25)CH□ Shifting amount to conversion value (Un\G150 to Un\G153)

Set the shifting amount to conversion value used for the shift function for each channel.

The digital operation value to which the shifting amount to conversion value is applied is stored in CH□ Digital operation value (Un\G54 to Un\G57) for each channel.

For details on the shift function, refer to the following.

- Shift Function (☞Page 117, Section 8.10)



(a) Setting range

The setting range is between -32768 and 32767.

(b) Enabling the setting

When the value is set, the shifting amount to conversion value which was set turns valid regardless of turning on then off Operating condition setting request (Y9).

(c) Default value

The default value is 0. (All channels)

(26)Mode switching setting (Un\G158, Un\G159)

Set the setting value for the mode to be switched to.

Mode to be switched to	Setting value	
	Un\G158	Un\G159
Normal mode	0964_H	4144_H
Offset/gain setting mode	4144_H	0964_H

(a) Enabling the setting

Turn on Operating condition setting request (Y9) to enable the setting.

(b) After the mode is switched

When the mode is switched, this area is cleared to 0 and Operating condition setting completed flag (X9) turns off.

After checking that Operating condition setting completed flag (X9) is off, turn off Operating condition setting request (Y9).

Point

When a value out of the above setting range is written, the mode is not switched and only the operating condition is changed.

(27)A/D conversion timing monitor value (Un\G160)

The value corresponding to the A/D conversion timing set in "Drive Mode Setting" is stored.

For details on the trigger conversion function, refer to the following.

- Trigger Conversion Function (☞Page 162, Section 8.14)

Setting for A/D conversion timing	Setting value
Normal	0
External Trigger Convert Request (External Input Terminal)	1
Internal Trigger Conversion Request (Buffer Memory)	2

(28)Inside trigger conversion request (Un\G161)

The conversion request of when "Internal Trigger Conversion Request (Buffer Memory)" is set as the A/D conversion timing set in "Drive Mode Setting" is performed.

For details on the trigger conversion function, refer to the following.

- Trigger Conversion Function (☞Page 162, Section 8.14)

Inside trigger conversion request	Setting value
No request	0
Conversion request	1

(a) Default value

The default value is No request (0).

Point

- When a value out of the above range is set, an error occurs. Error code (2201) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on. A/D conversion is not performed.
- To perform A/D conversion again using Inside trigger conversion request (Un\G161), change the setting in Inside trigger conversion request (Un\G161) from Conversion request (1) to No request (0).

(29)Trigger conversion completed flag (Un\G162)

Trigger conversion status can be checked with this flag.

For details on the trigger conversion function, refer to the following.

- Trigger Conversion Function (☞Page 162, Section 8.14)

Trigger conversion status	Trigger conversion completed flag (Un\G162)
Waiting for the completion	0
Conversion completed	1

(a) Trigger conversion completed

- With "External Trigger Convert Request (External Input Terminal)" or "Internal Trigger Conversion Request (Buffer Memory)" set in "Drive Mode Setting", the A/D conversion by trigger conversion request is turned to Conversion completed (1) when the conversion of all the channels where the A/D conversion is enabled are completed.
- When Trigger conversion completed clear request (Un\G163) is turned from No request (0) to Clear request (1) with Trigger conversion completed flag (Un\G162) being Conversion completed (1), the setting in Trigger conversion completed flag (Un\G162) is turned to Waiting for the completion (0).

(b) Clearing Trigger conversion completed flag (Un\G162)

Turn on then off Operating condition setting request (Y9) to clear Trigger conversion completed flag (Un\G162).

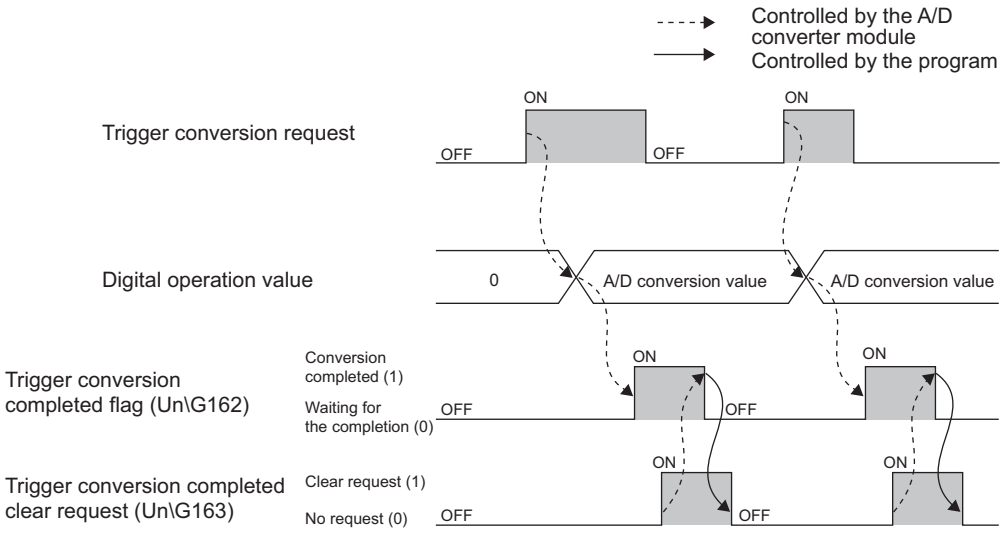
(30)Trigger conversion completed clear request (Un\G163)

Set this area to change the setting in Trigger conversion completed flag (Un\G162) from Conversion completed (1) to Waiting for the completion (0).

For details on the trigger conversion function, refer to the following.

- Trigger Conversion Function (☞Page 162, Section 8.14)

Internal trigger conversion request	Setting value
No request	0
Clear request	1



(a) Default value

The default value is No request (0).

Point

- When the setting in Trigger conversion completed flag (Un\G162) is Waiting for the completion (0), the setting does not change even if Trigger conversion completed clear request (Un\G163) is turned from No request (0) to Clear request (1).
- The setting in Trigger conversion completed flag (Un\G162) is Conversion completed (1) unless Trigger conversion completed clear request (Un\G163) is turned from No request (0) to Clear request (1). When trigger conversion request is input without changing the setting, A/D conversion is performed and the digital output value and digital operation value are updated.
- When a value out of the above range is set, an error occurs. Error code (2202) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on. Trigger conversion completed flag (Un\G162) does not change.

(31)CH□ Difference conversion trigger (Un\G172 to Un\G175)

Use this buffer memory area as a trigger to start or stop the difference conversion for each channel.

For details on the difference conversion function, refer to the following.

- Difference Conversion Function (☞Page 126, Section 8.12)

Difference conversion trigger	Setting value
No request	0
Trigger request	1

(a) Starting/Stopping the difference conversion

- When the setting value is turned from No request (0) to Trigger request (1), the difference conversion starts.
- When the setting value is turned from Trigger request (1) to No request (0), the difference conversion stops.

(b) Default value

The default value is No request (0). (All channels)

Point

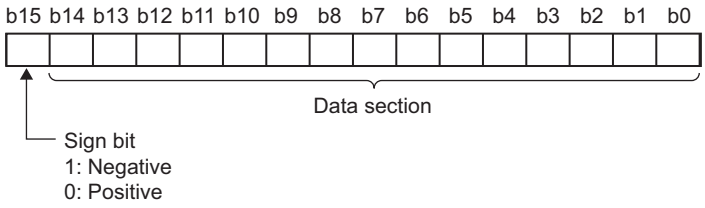
A channel where a value other than the above values is set brings about an error. Error code (37□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on. The difference conversion continues.

(32)CH□ Difference conversion reference value (Un\G180 to Un\G183)

This area stores the digital operation value at the start of the difference conversion as the difference conversion reference value.

For details on the difference conversion function, refer to the following.

- Difference Conversion Function (☞Page 126, Section 8.12)



(a) Setting range

The setting range is between -32768 and 32767.

Point

- The difference conversion reference value is updated when CH□ Difference conversion trigger (Un\G172 to Un\G175) is turned from No request (0) to Trigger request (1).
- Even if CH□ Difference conversion status flag (Un\G190 to Un\G193) is turned from Converting difference (1) to Not converted (0), CH□ Difference conversion reference value (Un\G180 to Un\G183) is not cleared.

(33)CH□ Difference conversion status flag (Un\G190 to Un\G193)

Difference conversion status can be checked with this flag.

For details on the difference conversion function, refer to the following.

- Difference Conversion Function (☞Page 126, Section 8.12)

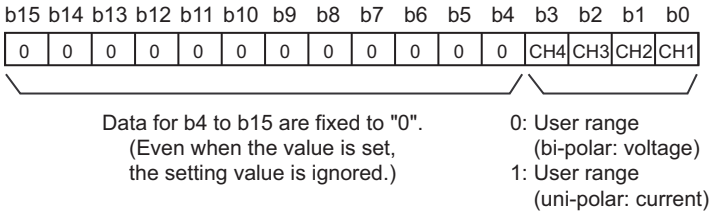
Difference conversion status	CH□ Difference conversion status flag (Un\G190 to Un\G193)
Not converted	0
Converting difference	1

- When CH□ Difference conversion trigger (Un\G172 to Un\G175) is turned from No request (0) to Trigger request (1), CH□ Difference conversion status flag (Un\G190 to Un\G193) is turned to Converting difference (1).
- When CH□ Difference conversion trigger (Un\G172 to Un\G175) is turned from Trigger request (1) to No request (0), CH□ Difference conversion status flag (Un\G190 to Un\G193) is turned from Converting difference (1) to Not converted (0).
- The setting in CH□ Difference conversion status flag (Un\G190 to Un\G193) is Converting difference (1) during difference conversion and is Not converted (0) before difference conversion.

(34)Pass data classification setting (Un\G200)

This area saves and restores the offset/gain setting value in user range setting.

Specify if the offset/gain setting value to be saved or restored is either voltage or current.


b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0
0 0 0 0 0 0 0 0 0 0 0 0 CH4 CH3 CH2 CH1
Data for b4 to b15 are fixed to "0".
(Even when the value is set,
the setting value is ignored.)
0: User range
(bi-polar: voltage)
1: User range
(uni-polar: current)

(35)CH1 Industrial shipment setting offset value (L) (Un\G202) to CH4 User range setting gain value (H) (Un\G233)

This area restores the offset/gain setting value in user range setting.

When the offset/gain setting of the user range setting is restored, the data used is stored with the following operation.

- Writing the initial setting by programming tool
- Turning on Operating condition setting request (Y9)*1
- Turning on User range write request (YA) (in offset/gain setting mode)

*1 The data is not saved when the setting value is written to Mode switching setting (Un\G158, Un\G159).

When restoring the offset/gain setting value in user range setting, set the data saved in this area to the same area in the A/D converter module where the data is restored.

For the setting procedure of offset/gain values or saving and restoring offset/gain values, refer to the following.

- Offset/gain Setting (☞Page 62, Section 7.5)
- Saving and Restoring Offset/gain Values (☞Page 175, Section 8.18)

(36)CH□ LPF Pass band edge frequency (Un\G300 to Un\G303)

Set the pass band edge frequency for the low pass filter for each channel.

For details on the digital filter, refer to the following.

- Digital filter (☞Page 80, Section 8.4 (5))

(a) Setting range

For the setting range, refer to the following.

- How to use the digital filters (☞Page 82, Section 8.4 (5) (b))

(b) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(c) Default value

The default value is 0. (All channels)

Point

A channel where a value other than the above values is set brings about an error. Error code (230□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on.

(37)CH□ HPF Pass band edge frequency (Un\G308 to Un\G311)

Set the pass band edge frequency for the high pass filter for each channel.

For details on the digital filter, refer to the following.

- Digital filter (☞Page 80, Section 8.4 (5))

(a) Setting range

For the setting range, refer to the following.

- How to use the digital filters (☞Page 82, Section 8.4 (5) (b))

(b) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(c) Default value

The default value is 0. (All channels)

Point

A channel where a value other than the above values is set brings about an error. Error code (231□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on.

(38)CH□ BPF Pass band edge frequency (Low) (Un\G316, Un\G318, Un\G320, Un\G322), CH□ BPF Pass band edge frequency (High) (Un\G317, Un\G319, Un\G321, Un\G323)

Set the pass band edge frequency for the band pass filter for each channel.

For details on the digital filter, refer to the following.

- Digital filter (☞Page 80, Section 8.4 (5))

(a) Setting range

For the setting range, refer to the following.

- How to use the digital filters (☞Page 82, Section 8.4 (5) (b))

(b) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(c) Default value

The default value is 0. (All channels)

Point

A channel where a value other than the above values is set brings about an error. Error code (232□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on.

(39)CH□ Attenuation band width (Un\G332 to Un\G335)

Set the attenuation band width, the boundary between the attenuation band and stop band, for each channel.
For details on the digital filter, refer to the following.

- Digital filter (☞Page 80, Section 8.4 (5))

[For the low pass filter]
Set the attenuation band width for each channel.
The sum of the LPF Pass band edge frequency and attenuation band width is the boundary between the attenuation band and stop band.
Frequency higher than the sum of the LPF Pass band edge frequency and attenuation band width is attenuated.
[For the high pass filter]
Set the attenuation band width for each channel.
The difference between the HPF Pass band edge frequency and attenuation band width is the boundary between the attenuation band and stop band.
Frequency lower than the difference between the HPF Pass band edge frequency and attenuation band width is attenuated.
[For the band pass filter]
Set the attenuation band width for each channel.

- The difference between the BPF Pass band edge frequency (Low) and attenuation band width is the boundary between the lower attenuation band and stop band.
  Frequency lower than the difference between the BPF Pass band edge frequency (Low) and attenuation band width is attenuated.
- The sum of the BPF Pass band edge frequency (High) and attenuation band width is the boundary between the higher attenuation band and stop band.
  Frequency higher than the sum of the BPF Pass band edge frequency (High) and attenuation band width is attenuated.

(a) Setting range

For the setting range, refer to the following.

- How to use the digital filters (☞Page 82, Section 8.4 (5) (b))

(b) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(c) Default value

The default value is 0. (All channels)

(40)CH□ Logging enable/disable setting (Un\G1000 to Un\G1003)

Set whether the logging is enabled or disabled for each channel.

For details on the logging function, refer to the following.

- Logging Function (☞Page 130, Section 8.13)

Logging enable/disable setting	Setting value
Enable	0
Disable	1

(a) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(b) Default value

The default value is Disable (1). (All channels)

Point

- Enabling the setting starts the logging.
- A channel where a value other than the above values is set brings about an error. Error code (200□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on. Logging cannot be performed.

(41)CH□ Logging hold request (Un\G1008 to Un\G1011)

Use Logging hold request (Un\G1008 to Un\G1011) as a trigger to hold (stop) the logging at any timing during the logging for each channel.

For details on the logging function, refer to the following.

- Logging Function (☞Page 130, Section 8.13)

Logging hold request	Setting value
OFF	0
ON	1

(a) Operation of the logging hold processing

- In the case that CH□ Hold trigger condition setting (Un\G1056 to Un\G1059) is set to Logging hold request (0), when CH□ Logging hold request (Un\G1008 to Un\G1011) changes from OFF (0) to ON (1), the logging hold processing starts.
- In the case that CH□ Hold trigger condition setting (Un\G1056 to Un\G1059) is set to either of Level trigger (condition: above) (1), Level trigger (condition: below) (2), or Level trigger (condition: pass through) (3), when the trigger condition is satisfied after CH□ Logging hold request (Un\G1008 to Un\G1011) changes from OFF (0) to ON (1), the logging hold processing starts.
  When the level trigger is enabled, use Logging hold request (Un\G1008 to Un\G1011) as an interlock to operate the level trigger.
- In the case that CH□ Hold trigger condition setting (Un\G1056 to Un\G1059) is set to Outside trigger (4), when an external trigger is detected after CH□ Logging hold request (Un\G1008 to Un\G1011) changes from OFF (0) to ON (1), the logging hold processing starts.
  When the outside trigger is enabled, use Logging hold request (Un\G1008 to Un\G1011) as an interlock to operate the outside trigger.
- If CH□ Logging hold request (Un\G1008 to Un\G1011) is turned from ON (1) to OFF(0) during logging hold processing, the hold status (stop) is cleared and the logging restarts.
- The hold status (stop) of logging can be checked with CH□ Logging hold flag (Un\G1016 to Un\G1019).

(b) Default value

The default value is OFF (0). (All channels)

Point

- A channel where a value other than the above values is set brings about an error. Error code (207□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on. The logging continues.
- When CH□ Logging enable/disable setting (Un\G1000 to Un\G1003) is set to Disable (1), the setting for CH□ Logging hold request (Un\G1008 to Un\G1011) is ignored.

(42)CH□ Logging hold flag (Un\G1016 to Un\G1019)

Hold (stop) status of logging can be checked with this flag.

For details on the logging function, refer to the following.

- Logging Function (☞Page 130, Section 8.13)

Hold (stop) status of logging	Stored value
OFF	0
ON	1

- Logging hold flag (Un\G1016 to Un\G1019) is turned to ON (1) when the status of logging changes to the hold (stop) from the status in which the logging is recording data in the logging data storage area.
- When the logging restarts by turning CH□ Logging hold request (Un\G1008 to Un\G1011) from ON (1) to OFF (0), CH□ Logging hold flag (Un\G1016 to Un\G1019) is turned to OFF (0).

(43)CH□ Logging data setting (Un\G1024 to Un\G1027)

When the logging function is used, set whether the logging data type is Digital output value or Digital operation value for each channel.

For details on the logging function, refer to the following.

- Logging Function (☞Page 130, Section 8.13)

Target of logging	Setting value
Digital output value	0
Digital operation value	1

(a) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(b) Default value

The default value is Digital operation value (1). (All channels)

Point

- A channel where a value other than the above values is set brings about an error. Error code (203□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on. Logging cannot be performed.
- When CH□ Logging enable/disable setting (Un\G1000 to Un\G1003) is set to Disable (1), the setting for CH□ Logging data setting (Un\G1024 to Un\G1027) is ignored.

(44)CH□ Logging cycle setting value (Un\G1032 to Un\G1035), CH□ Logging cycle unit setting (Un\G1040 to Un\G1043)

Set the cycle of storing the logging data for each channel.

- Set a value for one cycle in CH□ Logging cycle setting value (Un\G1032 to Un\G1035).
- Set a unit of cycle in CH□ Logging cycle unit setting (Un\G1040 to Un\G1043).

For details on the logging function, refer to the following.

- Logging Function (☞Page 130, Section 8.13)

(a) Setting range

The available setting range of CH□ Logging cycle setting value (Un\G1032 to Un\G1035) depends on the setting for CH□ Logging cycle unit setting (Un\G1040 to Un\G1043).

Logging cycle unit	Setting value of CH□ Logging cycle unit setting (Un\G1040 to Un\G1043)	Setting range of CH□ Logging cycle setting value (Un\G1032 to Un\G1035)
μs	0	40 to 32767
ms	1	1 to 32767
s	2	1 to 3600

(b) Actual logging cycle

The actual logging cycle is an integral multiple of the conversion cycle of the digital output value or digital operation value.

Ex. When the A/D conversion is performed for CH1 to CH4 with the sampling processing
→ The actual logging cycle is an integral multiple of 80μs (40μs × 2) with the value set in CH□ Logging cycle setting value (Un\G1032 to Un\G1035) and CH□ Logging cycle unit setting (Un\G1040 to Un\G1043) as the upper limit value.

(c) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(d) Default value

- The default value is 4 for CH□ Logging cycle setting value (Un\G1032 to Un\G1035). (All channels)
- The default value is ms (1) for CH□ Logging cycle unit setting (Un\G1040 to Un\G1043). (All channels)

Point

- In the channel where the following conditions are set, an error occurs. Error code (201□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on. Logging cannot be performed.
  - When a value out of the above setting range is set in either CH□ Logging cycle setting value (Un\G1032 to Un\G1035) or CH□ Logging cycle unit setting (Un\G1040 to Un\G1043)
  - When the set logging cycle is below the update cycle of data to be logged
- When CH□ Logging enable/disable setting (Un\G1000 to Un\G1003) is set to Disable (1), the settings for CH□ Logging cycle setting value (Un\G1032 to Un\G1035) and CH□ Logging cycle unit setting (Un\G1040 to Un\G1043) are ignored.

(45)CH□ Logging points after trigger (Un\G1048 to Un\G1051)

When the logging function is used, set the number of data points recorded from the rise of hold trigger (a request to stop logging) to logging holding (stops) for each channel.

For details on the logging function, refer to the following.

- Logging Function (☞Page 130, Section 8.13)

(a) Setting range

The setting range is between 1 and 10000.

(b) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(c) Default value

The default value is 5000. (All channels)

Point

- A channel where a value out of the above setting range is set brings about an error. Error code (204□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on. Logging cannot be performed.
- When CH□ Logging enable/disable setting (Un\G1000 to Un\G1003) is set to Disable (1), the setting for CH□ Logging points after trigger (Un\G1048 to Un\G1051) is ignored.

(46)CH□ Hold trigger condition setting (Un\G1056 to Un\G1059)

Set the hold trigger condition to be used by the logging function for each channel.

- To use the hold trigger request, set CH□ Hold trigger condition setting (Un\G1056 to Un\G1059) to Logging hold request (0).
- To use the logging level trigger, set CH□ Hold trigger condition setting (Un\G1056 to Un\G1059) to either Level trigger (condition: above) (1), Level trigger (condition: below) (2), or Level trigger (condition: pass through) (3).
- To use the logging outside trigger, set CH□ Hold trigger condition setting (Un\G1056 to Un\G1059) to Outside trigger (4).

For details on the logging function, refer to the following.

- Logging Function (☞Page 130, Section 8.13)

Setting	Setting value
Logging hold request	0
Level trigger (condition: above)	1
Level trigger (condition: below)	2
Level trigger (condition: pass through)	3
Outside trigger	4

(a) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(b) Default value

The default value is Logging hold request (0). (All channels)

Point

- A channel where a value other than the above values is set brings about an error. Error code (205□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on. Logging cannot be performed.
- When CH□ Logging enable/disable setting (Un\G1000 to Un\G1003) is set to Disable (1), the setting for CH□ Hold trigger condition setting (Un\G1056 to Un\G1059) is ignored.

(47)CH□ Trigger data (Un\G1064 to Un\G1067)

When the logging function is used, set the buffer memory address monitored for the condition of level trigger rising for each channel.

For details on the logging function, refer to the following.

- Logging Function (☞Page 130, Section 8.13)

(a) Setting range

The setting range is between 0 and 4999.

(b) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(c) Default value

Channel	Default value	Buffer memory to be monitored
CH1	54	CH1 Digital operation value (Un\G54)
CH2	55	CH2 Digital operation value (Un\G55)
CH3	56	CH3 Digital operation value (Un\G56)
CH4	57	CH4 Digital operation value (Un\G57)

Point

- A channel where a value out of the above setting range is set brings about an error. Error code (206□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on. Logging cannot be performed.
- Set CH□ Digital output value (Un\G11 to Un\G14), CH□ Digital operation value (Un\G54 to Un\G57), Level data □ (Un\G1072 to Un\G1081), or a buffer memory address with "R" in List of Buffer Memory Addresses to CH□ Trigger data (Un\G1064 to Un\G1067).

  Ex. Buffer memory address, system area, etc. with "R/W" or "W" in List of Buffer Memory Addresses

  For the details on the buffer memory address, refer to the following.

  - List of Buffer Memory Addresses (☞Page 32, Section 3.5)

(48)Level data □ (Un\G1072 to Un\G1081)

This area stores the data to be monitored when the level trigger of the logging function is used. Ten types of data are available: Level data 0 (Un\G1072) to Level data 9 (Un\G1081)

Use Level data □ (Un\G1072 to Un\G1081) to monitor device values in other than the A/D converter module and generate triggers.

For details on the logging function, refer to the following.

- Logging Function (☞Page 130, Section 8.13)

(a) Application example

To monitor the data register D100 in the CPU module and operate the level trigger in CH1, create a program as follows.

1. **Set CH1 Trigger data (Un\G1064) to 1073 (Level data 1). (When Level data 1 is used)**
2. **Store the storage data D100 in Level data 1 (Un\G1073) by the program continuously. (The start I/O number is set to 10_H in the following program example.)**



(b) Setting range

The setting range is between -32768 and 32767.

(c) Default value

The default value is 0 for all channels.

(49)CH□ Trigger setting value (Un\G1082 to Un\G1085)

When the logging function is used, set a level where a level trigger is generated for each channel.

For details on the logging function, refer to the following.

- Logging Function (☞Page 130, Section 8.13)

(a) Setting range

The setting range is between -32768 and 32767.

(b) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(c) Default value

The default value is 0. (All channels)

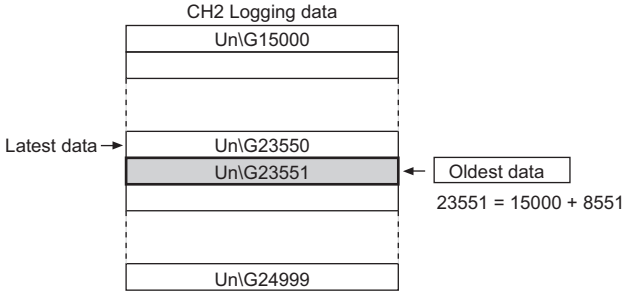
(50)CH□ Head pointer (Un\G1090 to Un\G1093)

The buffer memory address where the oldest data is stored can be checked in CH□ Logging data (Un\G5000 to Un\G44999). The difference between the buffer memory address where the oldest data is stored and the start address in CH□ Logging data (Un\G5000 to Un\G44999) is stored.

For details on the logging function, refer to the following.

- Logging Function (☞Page 130, Section 8.13)

Ex. When the value of CH2 Head pointer (Un\G1091) is 8551



Point

- The value in CH□ Head pointer (Un\G1090 to Un\G1093) is fixed to 0 since the oldest data is stored in the start address of CH□ Logging data (Un\G5000 to Un\G44999) while the data of the first 10000 points is being logged from beginning of the logging. After the 10001st data, CH□ Head pointer (Un\G1090 to Un\G1093) increases one by one each time data is stored.
- When CH□ Logging hold request (Un\G1008 to Un\G1011) is turned from ON (1) to OFF (0), CH□ Head pointer (Un\G1090 to Un\G1093) is cleared to 0.

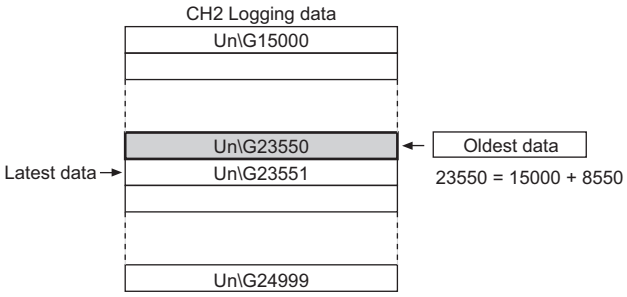
(51)CH☐ Latest pointer (Un\G1098 to Un\G1101)

The buffer memory address where the latest data is stored can be checked in CH☐ Logging data (Un\G5000 to Un\G44999). The difference between the buffer memory address where the latest data is stored and the start address in CH☐ Logging data (Un\G5000 to Un\G44999) is stored.

For details on the logging function, refer to the following.

- Logging Function (☞Page 130, Section 8.13)

Ex. When the value of CH2 Latest pointer (Un\G1099) is 8550



Point

- CH☐ Latest pointer (Un\G1098 to Un\G1101) increases one by one each time data is stored from the beginning of logging.
- When CH☐ Logging hold request (Un\G1008 to Un\G1011) is turned from ON (1) to OFF (0), CH☐ Latest pointer (Un\G1098 to Un\G1101) is cleared to 0.

(52)CH☐ Number of logging data (Un\G1106 to Un\G1109)

The number of data stored in the logging data storage area can be checked during the logging.

For details on the logging function, refer to the following.

- Logging Function (☞Page 130, Section 8.13)

Point

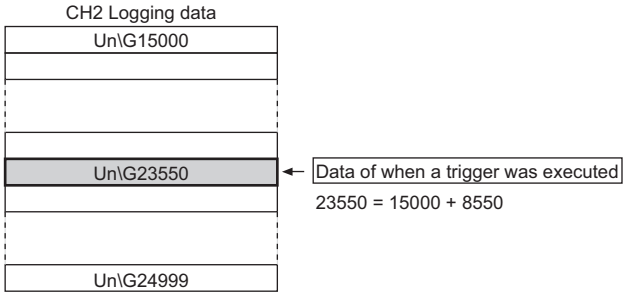
- The number of logging data increases one by one each time data is stored from the beginning of logging.
- When the value in the logging data storage area reaches 10000, CH☐ Number of logging data (Un\G1106 to Un\G1109) is fixed to 10000 since the value is overwritten from the start again.
- When CH☐ Logging hold request (Un\G1008 to Un\G1011) is turned from ON (1) to OFF (0), CH☐ Number of logging data (Un\G1106 to Un\G1109) is cleared to 0.

(53)CH☐ Trigger pointer (Un\G1114 to Un\G1117)

The address of buffer memory which stores the data of when a hold trigger (a request to stop logging) is executed can be checked in CH☐ Logging data (Un\G5000 to Un\G44999).
The difference between the address of buffer memory which stores the data of when a hold trigger (a request to stop logging) is executed and the start address in CH☐ Logging data (Un\G5000 to Un\G44999) is stored.
For details on the logging function, refer to the following.

- Logging Function (☞Page 130, Section 8.13)

Ex. When the value of CH2 Trigger pointer (Un\G1115) is 8550



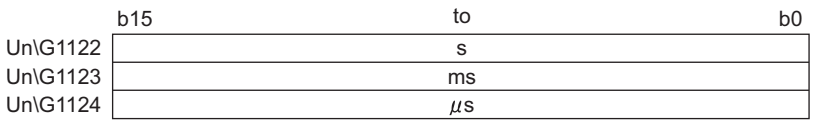
Point

- When CH☐ Logging hold request (Un\G1008 to Un\G1011) is turned from ON (1) to OFF (0), CH☐ Trigger pointer (Un\G1114 to Un\1117) is cleared to 0.

(54)CH☐ Logging cycle monitor value (Un\G1122 to Un\G1133)

This area stores the actual logging cycle which is calculated from the update cycle of data to be logged.
When Operating condition setting request (Y9) is turned on then off, the logging cycle is stored in CH☐ Logging cycle monitor value (Un\G1122 to Un\G1133) in the corresponding channel where the logging function is enabled.
For details on the logging function, refer to the following.

- Logging Function (☞Page 130, Section 8.13)



Ex. When the calculated value of logging cycle in CH1 is 6960μs

Buffer memory address	Stored value
Un\G1122	0 (s)
Un\G1123	6 (ms)
Un\G1124	960 (μs)

(55)CH□ Trigger detection time (Un\G1154 to Un\G1169)

The time that the hold trigger (a request to stop logging) is detected is recorded.

For details on the logging function, refer to the following.

- Logging Function (☞Page 130, Section 8.13)

	b15 to b8	b7 to b0
Un\G1154	First two digits of the year	Last two digits of the year
Un\G1155	Month	Day
Un\G1156	Hour	Minute
Un\G1157	Second	Day of the week

Item	Storage contents	Storage example*1
First two digits of the year/ Last two digits of the year	Stored in BCD code.	2011_H
Month/Day		329_H
Hour/Minute		1035_H
Second		40_H
Day of the week	One of the following values is stored for each day of the week in BCD code. • Sunday: 0 • Monday: 1 • Tuesday: 2 • Wednesday: 3 • Thursday: 4 • Friday: 5 • Saturday: 6	2_H

*1 Those are values when a hold trigger (a request to stop logging) is detected at 10:35:40 on Tuesday, March 29th, 2011.

Point

- Time units shorter than one second are not recorded.
- When CH□ Logging hold request (Un\G1008 to Un\G1011) is turned from ON (1) to OFF (0), CH□ Trigger detection time (Un\G1154 to Un\G1169) is cleared to 0.

(56)CH□ Loading interrupt enable/disable setting (Un\G1200 to Un\G1203)

Set whether the logging load detection function is enabled or disabled for each channel.

Generates an interrupt to the CPU module by setting a read pointer each time the number of data equal to the logging load points setting value is logged while CH□ Loading interrupt enable/disable setting (Un\G1200 to Un\G1203) is set to Enable (0).

For details on the logging function, refer to the following.

- Logging Function (☞Page 130, Section 8.13)

(a) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(b) Default value

The default value is Disable (1). (All channels)

Point

- A channel where a value other than Enable (0) and Disable (1) is set brings about an error. Error code (250□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on. Logging cannot be performed.
- The interrupt pointer to be used is preset but can be changed. To change the interrupt pointer, set the corresponding interrupt pointer with PLC Parameter of GX Works2.

(57)CH□ Logging load points setting value (Un\G1208 to Un\G1211)

An interrupt is generated to the CPU module each time the number of data equal to the set points is stored for each channel.

For details on the logging function, refer to the following.

- Logging Function (☞Page 130, Section 8.13)

(a) Setting range

The setting range is between 10 and 10000.

(b) Enabling the setting

Turn on then off Operating condition setting request (Y9) to enable the setting.

(c) Default value

The default value is 1000. (All channels)

Point

- A channel where a value out of the above setting range is set brings about an error. Error code (251□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, then the ERR. LED turns on. Logging cannot be performed.
- Set a value whose integral multiple is 10000. When a value whose integral multiple does not become 10000 is set for CH□ Logging load point setting value (Un\G1208 to Un\G1211), the actual logging load point becomes a maximum value whose integral multiple is 10000 within the set range.
- The value set in CH□ Logging load points setting value (Un\G1208 to Un\G1211) is stored in CH□ Logging load points monitor value (Un\G1232 to Un\G1235).

(58)CH□ This logging load pointer (Un\G1216 to Un\G1219)

In the interrupt processing with the logging load detection function used, the head pointer read from CH□ Logging data (Un\G5000 to Un\G44999) is stored. The stored value is calculated by the following formula each time the number of data equal to the logging load points monitor value is logged.

This logging load pointer = Latest pointer[*1] - Logging load points monitor value + 1

*1 Indicates the address where the latest data is stored in the logging data storage area.

For details on the logging function, refer to the following.

- Logging Function (☞Page 130, Section 8.13)

(a) Default value

The default value is -1. (All channels)

(59)CH□ Last logging load pointer (Un\G1224 to Un\G1227)

The this logging load pointer of when the previous pointer detection interrupt occurs is stored. This area is used to detect overlap of the interrupt processing of logging load pointer detection.
For details on the logging function, refer to the following.

- Logging Function (☞Page 130, Section 8.13)

(a) Default value

The default value is -1. (All channels)

(60)CH□ Logging load points monitor value (Un\G1232 to Un\G1235)

The value set in CH□ Logging load points setting value (Un\G1208 to Un\G1211) is stored for each channel.
For details on the logging function, refer to the following.

- Logging Function (☞Page 130, Section 8.13)

Point

- When a value whose integral multiple does not become 10000 is set for CH□ Logging load points setting value (Un\G1208 to Un\G1211), the maximum value whose integral multiple is 10000 within the range set in CH□ Logging load points setting value (Un\G1208 to Un\G1211) is stored.
- No values are stored in the channel where CH□ Logging enable/disable setting (Un\G1000 to Un\G1003) is set to Disable (1).

(61)Latest address of error history (Un\G1800)

The latest address of error history is stored.

(62)Error history No.☐ (Un\G1810 to Un\G1969)

Up to 16 errors that occurred in the module are recorded.

	b15 to b8	b7 to b0
Un\G1810	Error code	
Un\G1811	First two digits of the year	Last two digits of the year
Un\G1812	Month	Day
Un\G1813	Hour	Minute
Un\G1814	Second	Day of the week
Un\G1815 ⋮ Un\G1819	System area	

Item	Storage contents	Storage example*1
First two digits of the year/ Last two digits of the year	Stored in BCD code.	2011_H
Month/Day		329_H
Hour/Minute		1035_H
Second		40_H
Day of the week	One of the following values is stored for each day of the week in BCD code. • Sunday: 0 • Monday: 1 • Tuesday: 2 • Wednesday: 3 • Thursday: 4 • Friday: 5 • Saturday: 6	2_H

*1 Those are values when an error occurs at 10:35:40 on Tuesday, March 29th, 2011.

(63)CH☐ Logging data (Un\G5000 to Un\G44999)

This area stores the logged data. Up to 10000 data can be stored per channel. After the 10001st data for CH☐ Logging data (Un\G5000 to Un\G44999) for each channel, the logging is continued overwriting the data from the head.

For details on the logging function, refer to the following.

- Logging Function (☞Page 130, Section 8.13)

Point

- When Operating condition setting request (Y9) is turned on then off, the logging data in all the channels are cleared.
- Even if CH☐ Logging hold request (Un\G1008 to Un\G1011) is turned from ON (1) to OFF (0) and the logging restarts, the logged data is not cleared to 0.

Appendix 3 I/O Conversion Characteristic of A/D Conversion

I/O conversion characteristic of A/D conversion means the slope of the line connected between the offset value and gain value of when the analog signal (voltage or current input) from outside of the programmable controller is converted to the digital value.

(1) Offset value

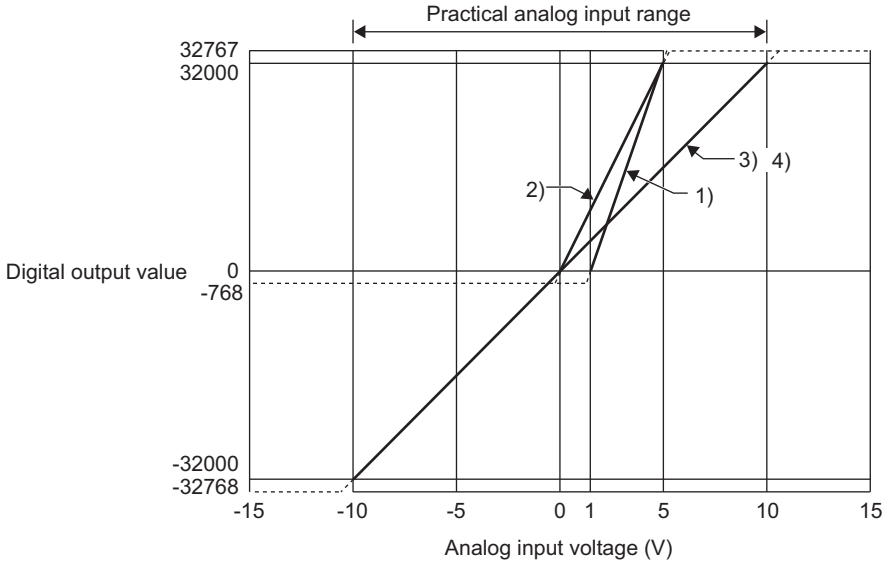
The analog input value (voltage or current) corresponding to the digital output value 0.

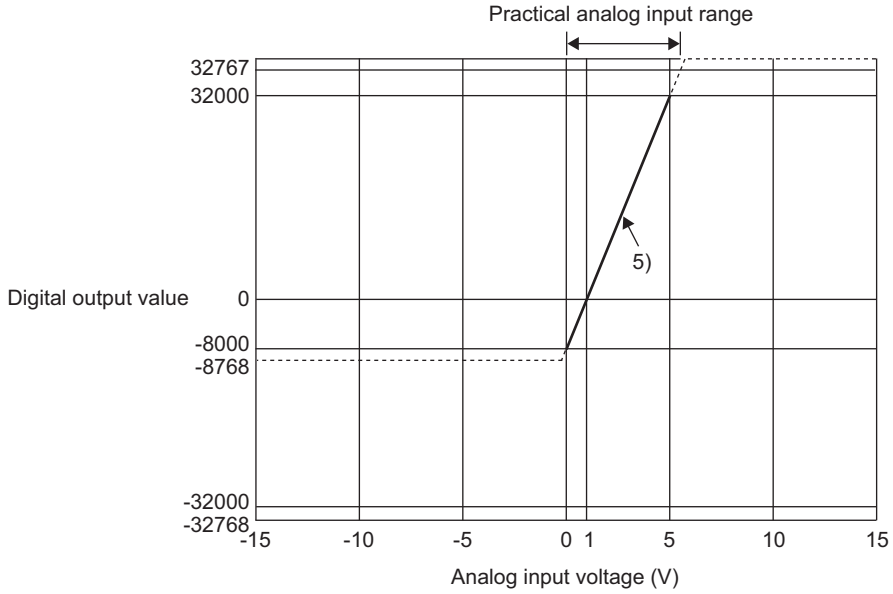
(2) Gain value

The analog input value (voltage or current) corresponding to the digital output value 32000.

(3) Voltage input characteristic

The following graph shows the voltage input characteristic.





No.	Input range setting	Offset value	Gain value	Digital output value[*2]	Maximum resolution
1)	1 to 5V	1V	5V	0 to 32000	125μV
2)	0 to 5V	0V	5V		156μV
3)	-10 to 10V	0V	10V	-32000 to 32000	312.5μV
4)	0 to 10V	0V	10V	0 to 32000	
5)	1 to 5V (Extended mode)	1V	5V	-8000 to 32000	125μV
–	User range setting (Bi-polar: voltage)	[*1]	[*1]	-32000 to 32000	200μV[*3]

*1 Set the offset value and gain value in user range setting within the range satisfying the following conditions.
If the following conditions are not satisfied, A/D conversion may not be properly performed.
• Setting range for offset value and gain value: -10 to 10V
• ((gain value)-(offset value)) ≥ 6.4V

*2 When analog input exceeds the range of digital output value, the digital output value is fixed to the maximum or minimum.

Input range setting	Digital output value	
	Minimum	Maximum
1 to 5V	-768	32767
0 to 5V		
-10 to 10V	-32768	
0 to 10V	-768	
1 to 5V (Extended mode)	-8768	
User range setting (Bi-polar: voltage)	-32768	

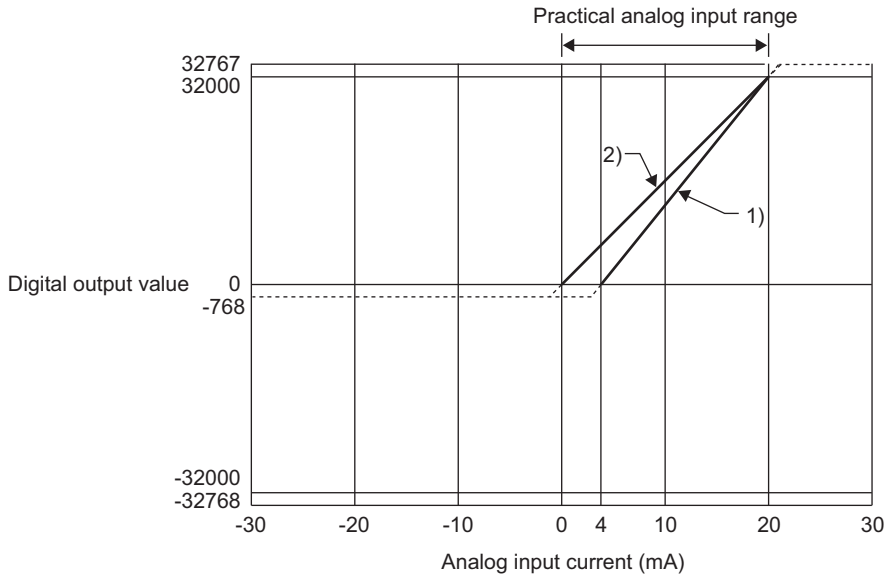
*3 Maximum resolution in the user range setting.

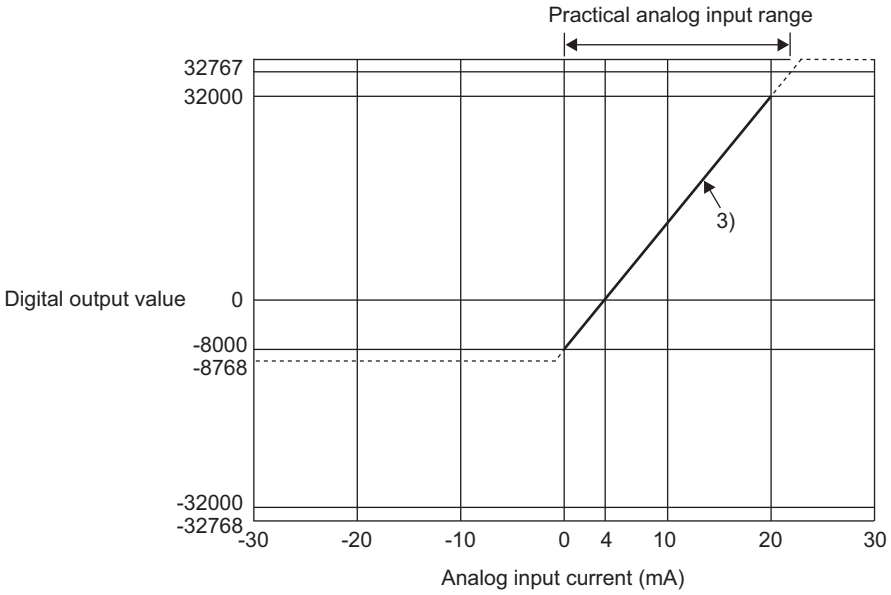
Point

- Use the value within the practical analog input range and practical digital output range for each input range. If a value is out of the range, the resolution and accuracy may not fall within the range of performance specifications. (Do not use the value in the dotted line region in the graph of voltage input characteristic.)
- Do not input a value of ±15V or more. This may damage the elements.

(4) Current input characteristic

The following graph shows the current input characteristic.





No.	Input range setting	Offset value	Gain value	Digital output value*2	Maximum resolution
1)	4 to 20mA	4mA	20mA	0 to 32000	500nA
2)	0 to 20mA	0mA	20mA		625nA
3)	4 to 20mA (Extended mode)	4mA	20mA	-8000 to 32000	500nA
–	User range setting (Uni-polar: current)	*1	*1	0 to 32000	400nA*3

*1 Set the offset value and gain value in user range setting within the range satisfying the following conditions.
If the following conditions are not satisfied, A/D conversion may not be properly performed.
• gain value ≤ 20mA, offset value ≥ 0mA
• ((gain value)-(offset value)) ≥ 12.8mA

*2 When analog input exceeds the range of the digital output value, the digital output value is fixed to the maximum or minimum.

Input range setting	Digital output value	
	Minimum	Maximum
4 to 20mA	-768	32767
0 to 20mA		
4 to 20mA (Extended mode)	-8768	
User range setting (Uni-polar: current)	-768	

*3 Maximum resolution in the user range setting.

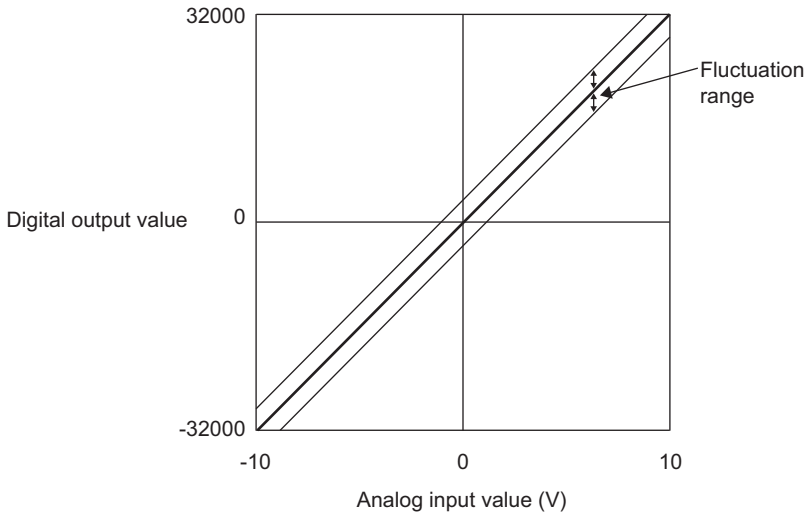
Point

- Use the value within the practical analog input range and practical digital output range for each input range. If a value is out of the range, the resolution and accuracy may not fall within the range of performance specifications. (Do not use the value in the dotted line region in the graph of current input characteristic.)
- Do not input a value of ±30mA or more. This may damage the elements.

Appendix 4 A/D Conversion Accuracy

The A/D conversion accuracy is the accuracy for the maximum value of digital output value.
Even if the offset/gain setting and input range are changed and thus the input characteristic is changed, the accuracy does not change and is kept within the range of the described performance specifications.

The following graph shows the fluctuation range of accuracy when the range of -10 to 10V is selected.
The reference accuracy is ±0.05% (±16digit) and the temperature coefficient is ±40.1ppm/°C or less. (Except when noise influences.)



Appendix 5 Dedicated Instruction

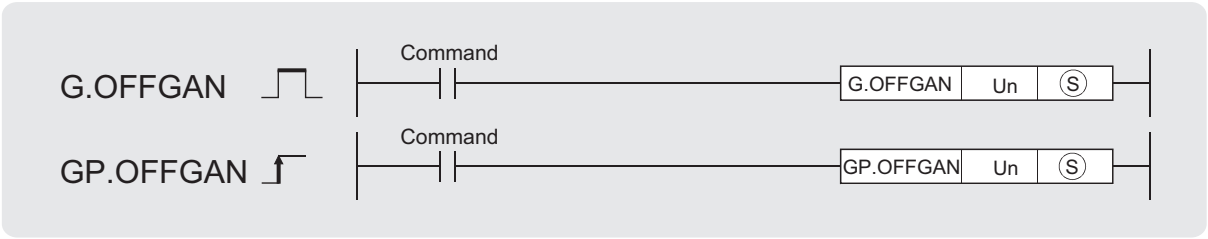
This chapter describes the dedicated instructions that can be used in the A/D converter module.

Appendix 5.1 Instruction list

The following table lists the dedicated instructions that can be used in the A/D converter module.

Instruction	Description
G(P).OFFGAN	• The operation mode is changed to the offset/gain setting mode. • The operation mode is changed to the normal mode.
G(P).OGLOAD	The offset/gain setting value in the user range setting is read out to the CPU module.
G(P).OGSTOR	The offset/gain setting value in the user range setting stored in the CPU module is restored to the A/D converter module.

Appendix 5.2 G(P).OFFGAN



Setting data	Internal device		R, ZR	J□\□		U□\G□	Zn	Constant K, H, $	Others
	Bit	Word		Bit	Word				
Ⓢ	–	○		–					

(1) Setting data

Device	Description	Setting range	Data type
Un	Start I/O number of module	0 to FE_H	BIN 16 bits
Ⓢ	Mode change 0: Changed to the normal mode 1: Changed to the offset/gain setting mode When a value other than the above is set, the mode is changed to the offset/gain setting mode.	0, 1	BIN 16 bits

(2) Functions

This instruction switches the operation mode of the A/D converter module.

- Normal mode → offset/gain setting mode (Offset/gain setting mode flag (XA) is on.)
- Offset/gain setting mode → normal mode (Offset/gain setting mode flag (XA) is off.)

Point

- When the mode is switched from the offset/gain setting mode to the normal mode, Module READY (X0) turns off then on. Note the initial setting process is performed at the switching of the mode if a sequence program executes the initial setting when Module READY (X0) turns on.
- When the mode is switched from the offset/gain setting mode to the normal mode, the A/D converter module operates under the previous operating condition.

(3) Errors

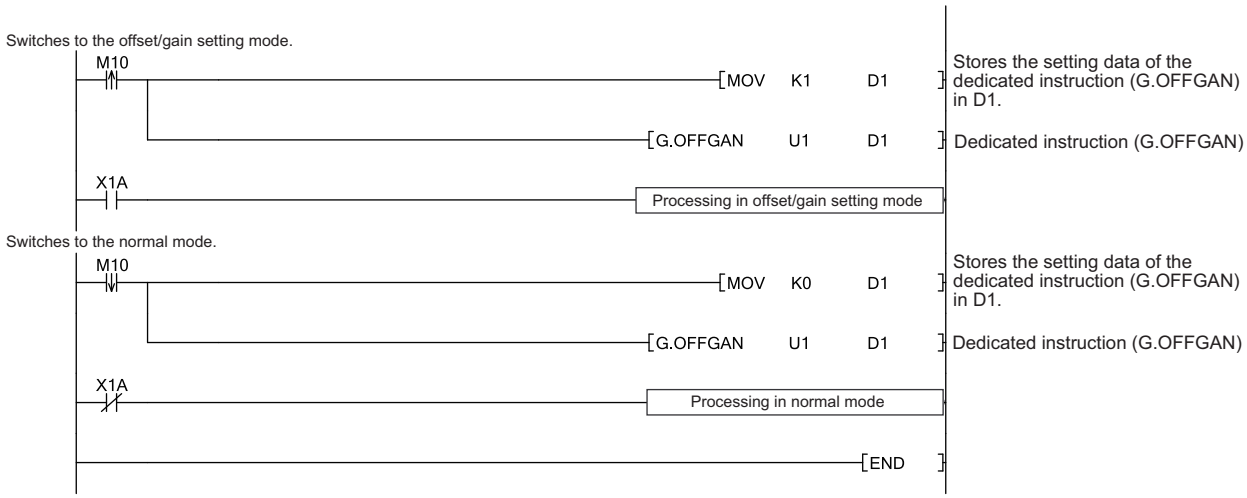
The instruction has no errors.

(4) Program example

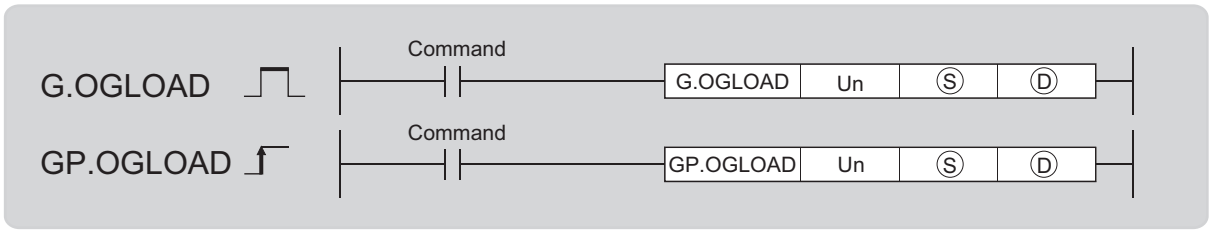
The following shows the program of the A/D converter module installed in I/O number X/Y10 to X/Y1F, with the following conditions:

• turning on M10 switches the operation mode to the offset/gain setting mode, and

• turning off M10 restores the operation mode to the normal mode.



Appendix 5.3 G(P).OGLOAD



Setting data	Internal device		R, ZR	J□\□		U□\G□	Zn	Constant K, H, $	Others
	Bit	Word		Bit	Word				
Ⓢ	−	○		−					
Ⓓ	○			−					

(1) Setting data

Device	Description	Setting range	Data type
Un	Start I/O number of module	0 to FE_H	BIN 16 bits
Ⓢ	Start number of device where the control data is stored	Within the range of specified device	Device name
Ⓓ	Device which turns on for one scan at the processing completion of the dedicated instruction In error completion, Ⓓ+1 also turns on.	Within the range of specified device	Bit

(2) Control data

Device	Item	Setting data	Setting range	Set by
Ⓢ	System area	–	–	–
Ⓢ+1	Completion status	The status on instruction completion is stored. 0: Normal completion Other than 0: Error completion (error code)	–	System
Ⓢ+2	Pass data classification setting[*1]	Specify the type of offset/gain setting value to read out. 0: User range (bi-polar: voltage) 1: User range (uni-polar: current) b15 b8 b7 b6 b5 b4 b3 b2 b1 b0 0 ~ ~ ~ ~ ~ 0 CH4 CH3 CH2 CH1	0000_H to $000F_H$	User
Ⓢ+3	System area	–	–	–
Ⓢ+4	CH1 Industrial shipment setting offset value (L)	–	–	System
Ⓢ+5	CH1 Industrial shipment setting offset value (H)	–	–	System
Ⓢ+6	CH1 Industrial shipment setting gain value (L)	–	–	System
Ⓢ+7	CH1 Industrial shipment setting gain value (H)	–	–	System
Ⓢ+8	CH2 Industrial shipment setting offset value (L)	–	–	System
Ⓢ+9	CH2 Industrial shipment setting offset value (H)	–	–	System
Ⓢ+10	CH2 Industrial shipment setting gain value (L)	–	–	System
Ⓢ+11	CH2 Industrial shipment setting gain value (H)	–	–	System
Ⓢ+12	CH3 Industrial shipment setting offset value (L)	–	–	System
Ⓢ+13	CH3 Industrial shipment setting offset value (H)	–	–	System
Ⓢ+14	CH3 Industrial shipment setting gain value (L)	–	–	System
Ⓢ+15	CH3 Industrial shipment setting gain value (H)	–	–	System
Ⓢ+16	CH4 Industrial shipment setting offset value (L)	–	–	System
Ⓢ+17	CH4 Industrial shipment setting offset value (H)	–	–	System
Ⓢ+18	CH4 Industrial shipment setting gain value (L)	–	–	System
Ⓢ+19	CH4 Industrial shipment setting gain value (H)	–	–	System
Ⓢ+20	CH1 User range setting offset value (L)	–	–	System
Ⓢ+21	CH1 User range setting offset value (H)	–	–	System
Ⓢ+22	CH1 User range setting gain value (L)	–	–	System
Ⓢ+23	CH1 User range setting gain value (H)	–	–	System
Ⓢ+24	CH2 User range setting offset value (L)	–	–	System
Ⓢ+25	CH2 User range setting offset value (H)	–	–	System
Ⓢ+26	CH2 User range setting gain value (L)	–	–	System
Ⓢ+27	CH2 User range setting gain value (H)	–	–	System
Ⓢ+28	CH3 User range setting offset value (L)	–	–	System
Ⓢ+29	CH3 User range setting offset value (H)	–	–	System
Ⓢ+30	CH3 User range setting gain value (L)	–	–	System

Device	Item	Setting data	Setting range	Set by
Ⓢ+31	CH3 User range setting gain value (H)	–	–	System
Ⓢ+32	CH4 User range setting offset value (L)	–	–	System
Ⓢ+33	CH4 User range setting offset value (H)	–	–	System
Ⓢ+34	CH4 User range setting gain value (L)	–	–	System
Ⓢ+35	CH4 User range setting gain value (H)	–	–	System

*1 Configure the setting of Pass data classification setting Ⓢ+2 only.
When the data is written to the area to be set by system, offset/gain setting values are not correctly read out.

(3) Functions

- This instruction reads out the offset/gain setting value in the user range setting of the A/D converter module to the CPU module.
- The interlock signal of the G(P).OGLOAD instruction includes a completion device Ⓓ and a completion status indication device Ⓓ+1.

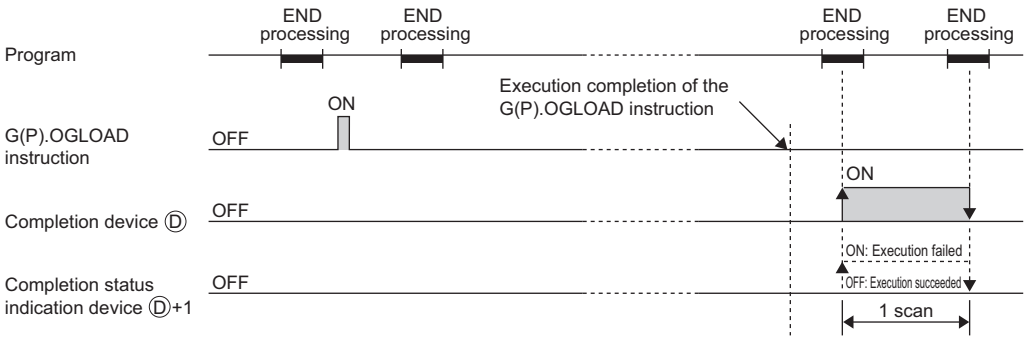
(a) Completion device

The device turns on at the END processing for the scan where the G(P).OGLOAD instruction is completed, and turns off at the next END processing.

(b) Completion status indication device

This device turns on then off depending on the status of the G(P).OGLOAD instruction completion.

- Normal completion: The device is kept to be off.
- Error completion: The device turns on at the END processing for the scan where the G(P).OGLOAD instruction is completed, and turns off at the next END processing.

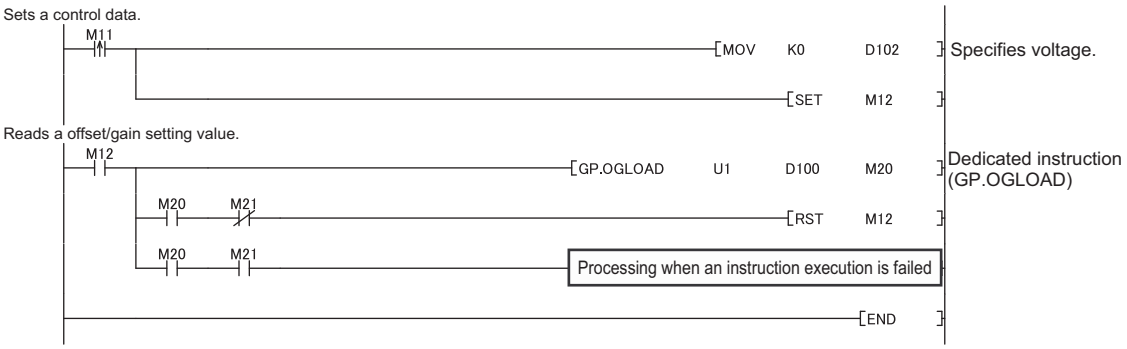


(4) Errors

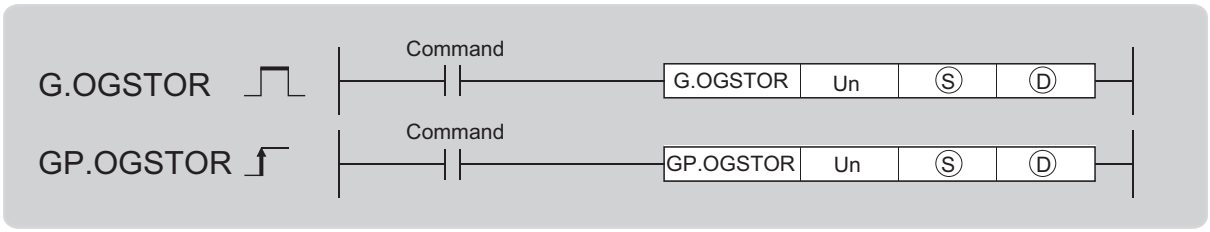
The instruction has no errors.

(5) Program example

The following shows the program to read out the offset/gain setting value of the A/D converter module, which is installed in I/O number X/Y10 to X/Y1F, by turning on M11.



Appendix 5.4 G(P).OGSTOR



Setting data	Internal device		R, ZR	J□\□		U□\G□	Zn	Constant K, H, $	Others
	Bit	Word		Bit	Word				
Ⓢ	–	○		–					
Ⓓ	○			–					

(1) Setting data

Device	Description	Setting range	Data type
Un	Start I/O number of module	0 to FE_H	BIN 16 bits
Ⓢ*1	Start number of device where the control data is stored	Within the range of specified device	Device name
Ⓓ	Device which turns on for one scan at the processing completion of the dedicated instruction In error completion, Ⓓ+1 also turns on.	Within the range of specified device	Bit

*1 Specify the device specified to Ⓢ on execution of the G(P).OGLOAD instruction.
Do not change the data which is read out by the G(P).OGLOAD instruction. If the data is changed, the normal operation may not be ensured.

(2) Control data

Device	Item	Setting data	Setting range	Set by
Ⓢ	System area	–	–	–
Ⓢ+1	Completion status	The status on instruction completion is stored. 0: Normal completion Other than 0: Error completion (error code)	–	System
Ⓢ+2	Pass data classification setting	The value which is set for Pass data classification setting Ⓢ+2 by the G(P).OGLOAD instruction is restored. 0: User range (bi-polar: voltage) 1: User range (uni-polar: current) b15 b8 b7 b6 b5 b4 b3 b2 b1 b0 0 ~ ~ ~ ~ ~ 0 CH4 CH3 CH2 CH1	0000_H to $000F_H$	System
Ⓢ+3	System area	–	–	–
Ⓢ+4	CH1 Industrial shipment setting offset value (L)	–	–	System
Ⓢ+5	CH1 Industrial shipment setting offset value (H)	–	–	System
Ⓢ+6	CH1 Industrial shipment setting gain value (L)	–	–	System
Ⓢ+7	CH1 Industrial shipment setting gain value (H)	–	–	System
Ⓢ+8	CH2 Industrial shipment setting offset value (L)	–	–	System
Ⓢ+9	CH2 Industrial shipment setting offset value (H)	–	–	System
Ⓢ+10	CH2 Industrial shipment setting gain value (L)	–	–	System
Ⓢ+11	CH2 Industrial shipment setting gain value (H)	–	–	System
Ⓢ+12	CH3 Industrial shipment setting offset value (L)	–	–	System
Ⓢ+13	CH3 Industrial shipment setting offset value (H)	–	–	System
Ⓢ+14	CH3 Industrial shipment setting gain value (L)	–	–	System
Ⓢ+15	CH3 Industrial shipment setting gain value (H)	–	–	System
Ⓢ+16	CH4 Industrial shipment setting offset value (L)	–	–	System
Ⓢ+17	CH4 Industrial shipment setting offset value (H)	–	–	System
Ⓢ+18	CH4 Industrial shipment setting gain value (L)	–	–	System
Ⓢ+19	CH4 Industrial shipment setting gain value (H)	–	–	System
Ⓢ+20	CH1 User range setting offset value (L)	–	–	System
Ⓢ+21	CH1 User range setting offset value (H)	–	–	System
Ⓢ+22	CH1 User range setting gain value (L)	–	–	System
Ⓢ+23	CH1 User range setting gain value (H)	–	–	System
Ⓢ+24	CH2 User range setting offset value (L)	–	–	System
Ⓢ+25	CH2 User range setting offset value (H)	–	–	System
Ⓢ+26	CH2 User range setting gain value (L)	–	–	System
Ⓢ+27	CH2 User range setting gain value (H)	–	–	System
Ⓢ+28	CH3 User range setting offset value (L)	–	–	System
Ⓢ+29	CH3 User range setting offset value (H)	–	–	System

Device	Item	Setting data	Setting range	Set by
Ⓢ+30	CH3 User range setting gain value (L)	–	–	System
Ⓢ+31	CH3 User range setting gain value (H)	–	–	System
Ⓢ+32	CH4 User range setting offset value (L)	–	–	System
Ⓢ+33	CH4 User range setting offset value (H)	–	–	System
Ⓢ+34	CH4 User range setting gain value (L)	–	–	System
Ⓢ+35	CH4 User range setting gain value (H)	–	–	System

(3) Functions

- The offset/gain setting value in the user range setting stored in the CPU module is restored to the A/D converter module.
- The interlock signal of the G(P).OGSTOR instruction includes a completion device Ⓓ and a completion status indication device Ⓓ+1.
- The reference accuracy after the restoration of the offset/gain setting value decreases approximately three times or less compared to that before the restoration.

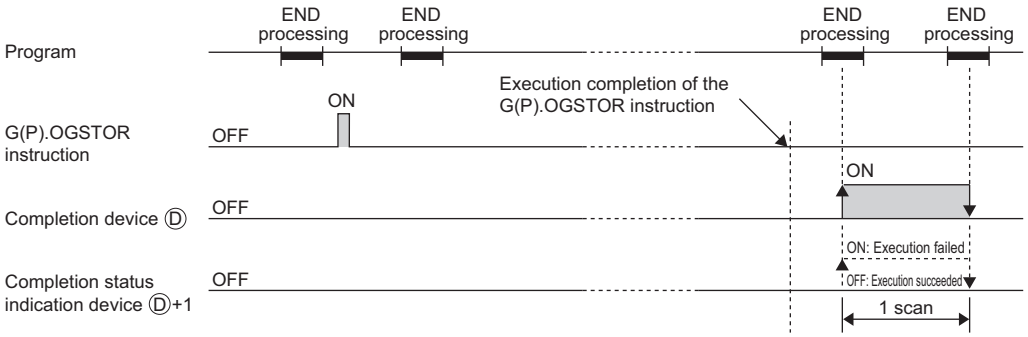
(a) Completion device

The device turns on at the END processing for the scan where the G(P).OGSTOR instruction is completed, and turns off at the next END processing.

(b) Completion status indication device

This device turns on then off depending on the status of the G(P).OGSTOR instruction completion.

- Normal completion: The device is kept to be off.
- Error completion: The device turns on at the END processing for the scan where the G(P).OGSTOR instruction is completed, and turns off at the next END processing.



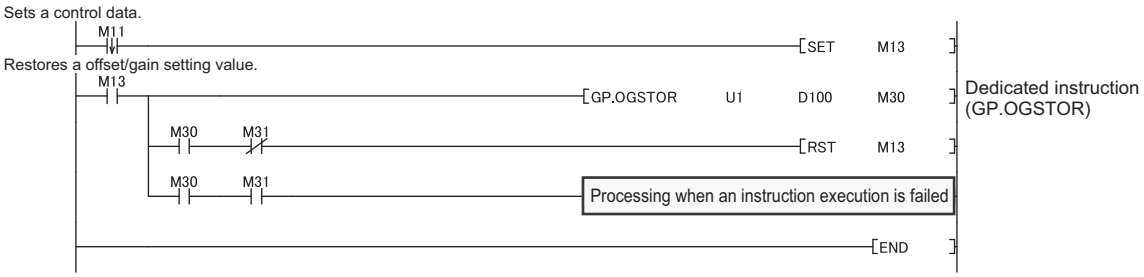
(4) Errors

In the following cases, an error occurs and an error code is stored in a completion status area Ⓢ+1.

Error code	Description of operation error
161	The G(P).OGSTOR instruction is executed in offset/gain setting mode.
162	The G(P).OGSTOR instruction is continuously executed.
163	• The G(P).OGSTOR instruction is executed to the model different from the one to which the G(P).OGLOAD instruction is executed. • The G(P).OGSTOR instruction has been executed before the execution of the G(P).OGLOAD instruction.

(5) Program example

The following shows the programs to write the offset/gain setting value to the A/D converter module, which is installed in I/O number X/Y10 to X/Y1F, by turning off M11.



Appendix 6 Checking Serial Number and Function Version

For details on how to check the serial number and function version, refer to the following.

MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)

MELSEC-L CC-Link IE Field Network Head Module User's Manual

Appendix 7 When Using GX Developer

Appendix 7 describes the operating procedure when GX Developer is used.

(1) Compatible software version

For the compatible software versions, refer to the following.

MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)

Appendix 7.1 Operation of GX Developer

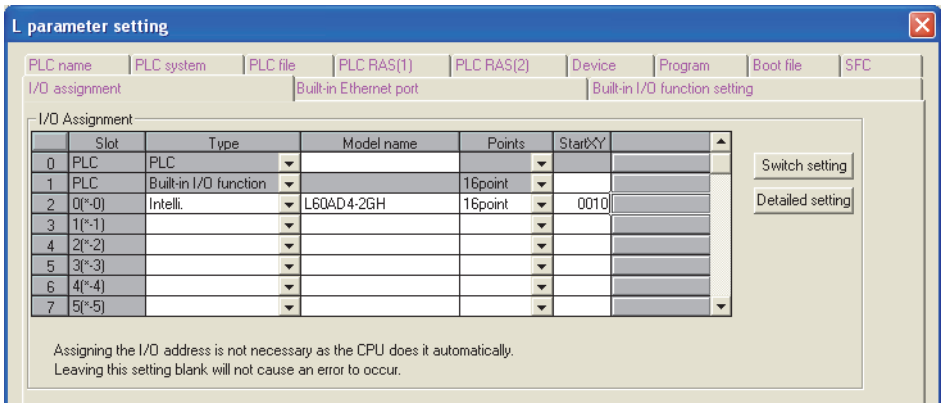
Configure the setting on the following window when using GX Developer.

Window name	Application	Reference
I/O assignment	Set the type of module installed and the range of I/O signal.	Page 297, Appendix 7.1 (1)
Switch setting	Configure the switch setting of an intelligent function module.	Page 298, Appendix 7.1 (2)
Offset/gain setting	Configure the setting when using the user range setting for the input range.	Page 65, Section 7.5.2

(1) I/O assignment

Configure the setting from "I/O assignment" in "PLC parameter".

Parameter ⇨ [PLC parameter] ⇨ [I/O assignment]

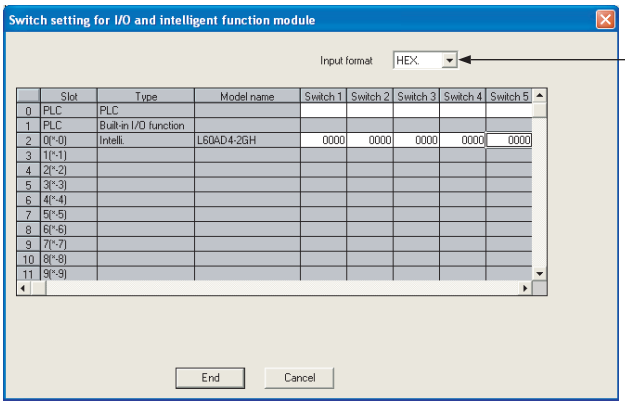


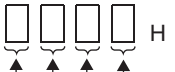
Item	Description
Type	Select "Intelli.".
Model name	Enter the model name of the A/D converter module.
Points	Select "16 point".
Start XY	Enter a desired start I/O number of the A/D converter module.

(2) Intelligent function module switch setting

Configure the setting from "Switch setting" in "PLC parameter".

Parameter ⇨ [PLC parameter] ⇨ [I/O assignment] ⇨ Click the Switch Setting button.



<table>
<tr><th>Item</th><th colspan="2">Setting item</th></tr>
<tr><td>Switch 1</td><td>Input range setting
(CH1 to CH4)
 
CH4 CH3 CH2 CH1</td><td>
<table>
<tr><th>Analog input range</th><th>Input range setting</th></tr>
<tr><td>4 to 20mA</td><td>0_H</td></tr>
<tr><td>0 to 20mA</td><td>1_H</td></tr>
<tr><td>1 to 5V</td><td>2_H</td></tr>
<tr><td>0 to 5V</td><td>3_H</td></tr>
<tr><td>-10 to 10V</td><td>4_H</td></tr>
<tr><td>0 to 10V</td><td>5_H</td></tr>
<tr><td>4 to 20mA (Extended mode)</td><td>A_H</td></tr>
<tr><td>1 to 5V (Extended mode)</td><td>B_H</td></tr>
<tr><td>User range setting
(Uni-polar: current)</td><td>E_H</td></tr>
<tr><td>User range setting
(Bi-polar: voltage)</td><td>F_H</td></tr>
</table>
</td></tr>
<tr><td>Switch 2</td><td colspan="2">0: Fixed (blank)</td></tr>
<tr><td>Switch 3</td><td colspan="2">0: Fixed (blank)</td></tr>
<tr><td>Switch 4</td><td colspan="2"> 
H
0H: Fixed
A/D Conversion Timing*3
0H: Normal
1H: External Trigger Convert Request (External Input Terminal)
2H to FH (value other than 0H and 1H)*1*2
: Internal Trigger Conversion Request (Buffer Memory)
0H: Fixed
Drive Mode Setting
0H : Normal (A/D Converter Processing) Mode
1H to FH (value other than 0H)*1 : Offset-Gain Setting Mode</td></tr>
<tr><td>Switch 5</td><td colspan="2">0: Fixed (blank)</td></tr>
</table>

*1 The operation is the same when any value within the setting range is set.

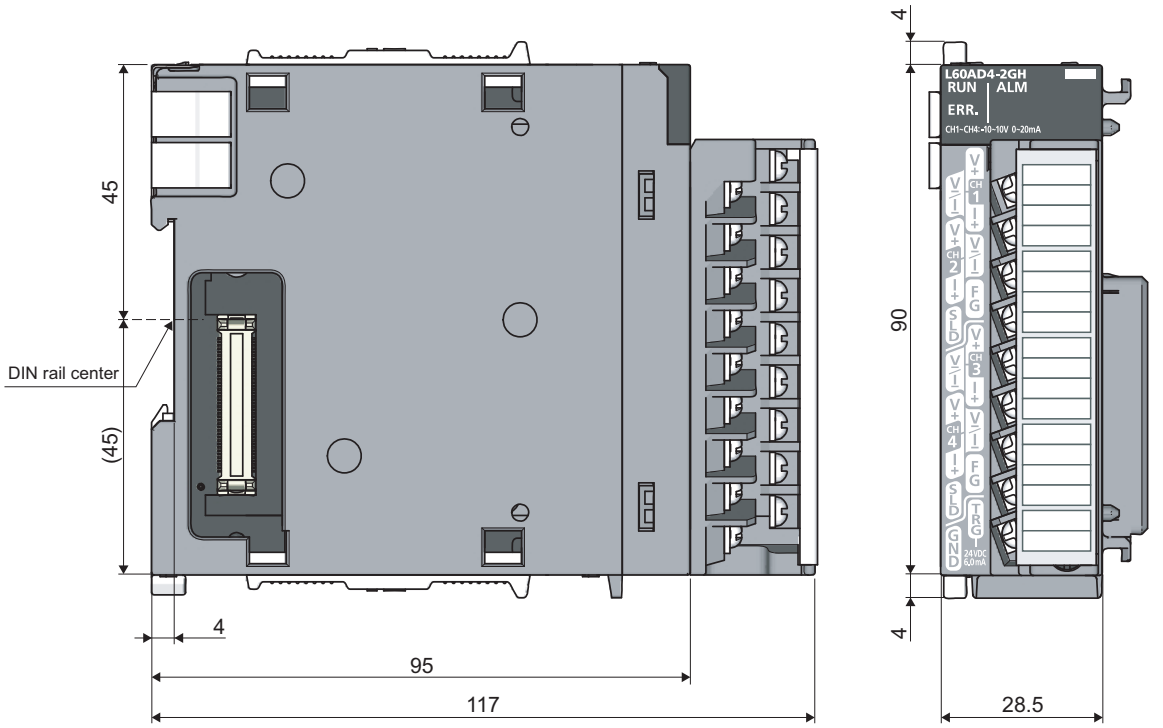
*2 If the operation mode is set to Normal (A/D converter processing) mode (0_H), Normal (0_H), External Trigger Convert Request (External Input Terminal) (1_H), or Internal Trigger Conversion Request (Buffer Memory) (2_H to F_H) can be set as the A/D conversion timing.
If the operation mode is set to Offset-Gain Setting Mode (1_H to F_H), the setting for the A/D conversion timing is ignored and the operation mode is set to Normal (0_H) in the internal operation.

*3 If the operation mode is set to Normal (A/D converter processing) mode (0_H) and a value other than Normal (0_H) is set as the A/D conversion timing, the mode transitions to the trigger conversion mode when the system is powered off then on or the CPU module is reset. The trigger conversion function can be used in the trigger conversion mode.

Appendix 8 External Dimensions

The following figure shows the external dimensions of A/D converter module.

(1) L60AD4-2GH



(Unit: mm)

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REVISIONS

*The manual number is given on the bottom left of the back cover.

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[Gratis Warranty Term]
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[Gratis Warranty Range]

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MELSEC-L Dual Channel Isolated High Resolution Analog-Digital Converter Module User's Manual

MODEL	L60AD4-2GH-U-E
MODEL CODE	13JZ72
SH(NA)-081103ENG-A(1302)MEE	

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